Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts

By:

John R. Slate
Ana Rojas-LeBouef

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C O N N E X I O N S

Rice University, Houston, Texas

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Introduction: Why a Book on Statistical Help for Graduate Students and Faculty?[1]

NOTE: This Chapter has been peer-reviewed, accepted, and endorsed by the National Council of Professors of Educational Administration (NCPEA) as a significant contribution to the scholarship and practice of education administration. Formatted and edited in Connexions by Theodore Creighton and Brad Bizzell, Virginia Tech, Janet Tareilo, Stephen F. Austin State University, and Thomas Kersten, Roosevelt University.

This chapter is part of a larger Collection (Book) and is available at: *Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts* [2]

NOTE: Slate and LeBouef have written a "companion book" which is available at: *Preparing and Presenting Your Statistical Findings: Model Write Ups* [3]

Authors Information

John R. Slate is a Professor at Sam Houston State University where he teaches Basic and Advanced Statistics courses, as well as professional writing, to doctoral students in Educational Leadership and Counseling. His research interests lie in the use of educational databases, both state and national, to reform school practices. To date, he has chaired and/or served over 100 doctoral student dissertation committees. Recently, Dr. Slate created a website, Writing and Statistical Help[4] to assist students and faculty with both statistical assistance and in editing/writing their dissertations/theses and manuscripts.

[1] This content is available online at <http://cnx.org/content/m37280/1.2/>.
[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[3] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[4] http://cnx.org/content/m37280/latest/www.writingandstatisticalhelp.com

Ana Rojas-LeBouef is a Literacy Specialist at the Reading Center at Sam Houston State University where she teaches developmental reading courses. She recently completed her doctoral degree in Reading, where she conducted a 16-year analysis of Texas statewide data regarding the achievement gap. Her research interests lie in examining the inequities in achievement among ethnic groups. Dr. Rojas-LeBouef also assists students and faculty in their writing and statistical needs on the Writing and Statistical website, Writing and Statistical Help[5]

Editors Information

Theodore B. Creighton, is a Professor at Virginia Tech and the Publications Director for NCPEA Publications[6] , the Founding Editor of Education Leadership Review,[7] and the Senior Editor of the NCPEA Connexions Project.

Brad E. Bizzell, is a recent graduate of the Virginia Tech Doctoral Program in Educational Leadership and Policy Studies, and is a School Improvement Coordinator for the Virginia Tech Training and Technical Assistance Center. In addition, Dr. Bizzell serves as an Assistant Editor of the NCPEA Connexions Project in charge of technical formatting and design.

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Thomas Kersten is a Professor at Roosevelt University in Chicago. Dr. Kersten is widely published and an experienced editor and is the author of Taking the Mystery Out of Illinois School Finance[8] , a Connexions Print on Demand publication. He is also serving as Editor in Residence for this book by Slate and LeBouef.

1.1 Introduction: Why a Book for Helping Students and Faculty with SPSS and Writing Help?

In the past two decades of teaching basic and advanced statistical procedures, we have observed student after student who experienced difficulty with using the Statistical Package for the Social Sciences (SPSS) and with interpreting the voluminous output generated by SPSS. These difficulties, along with statistics anxiety experienced by many students, led us to develop a specific and detailed set of steps for students to follow. Students reported to us, over and over, how helpful the point-and-click steps were to them in allowing them to use SPSS. Some students, even with the steps, still managed to experience difficulty in being able to use SPSS successfully. As a result, we generated screenshots for every major point-and-click step. This combination of steps and screenshots has met with excellent student satisfaction and, most importantly for us as instructors, has enhanced their ability to be successful in using SPSS.

We have written this textbook in hopes of facilitating individuals' success in using SPSS for their statistical analyses and in interpreting the SPSS output properly. Graduate and undergraduate students who take a statistics course in which SPSS is used will find these steps and screenshots to be very practical and very easy to follow. Doctoral students, who completed their statistics course years ago, but who are now working on their dissertation data analysis will find this textbook to be a practical step-by-guide. Finally, faculty members who engage in scholarly activities but are years removed from their own statistics courses will find this textbook to be helpful.

We hope that you find our materials helpful to you in your use of SPSS and in your interpretation of SPSS output. This textbook reflects our efforts and interests in making statistical analysis less threatening and less anxiety-producing than many persons find it to be. Currently, great emphasis is placed on accountability in

[5] http://cnx.org/content/m37280/latest/www.writingandstatisticalhelp.com
[6] http://www.ncpeapublications.org
[7] http://ncpeapublications.org/about-elr.html
[8] http://cnx.org/content/col10606/latest/

educational settings. Being able to analyze data, of which an abundance clearly exists, in an interpretable way is essential, especially if we want to make the educational lives of our students better.

John R. Slate, Sam Houston State University
Ana Rojas-LeBouef, Sam Houston State University

Chapter 2

Calculating Descriptive Statistics[1]

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2.1

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[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
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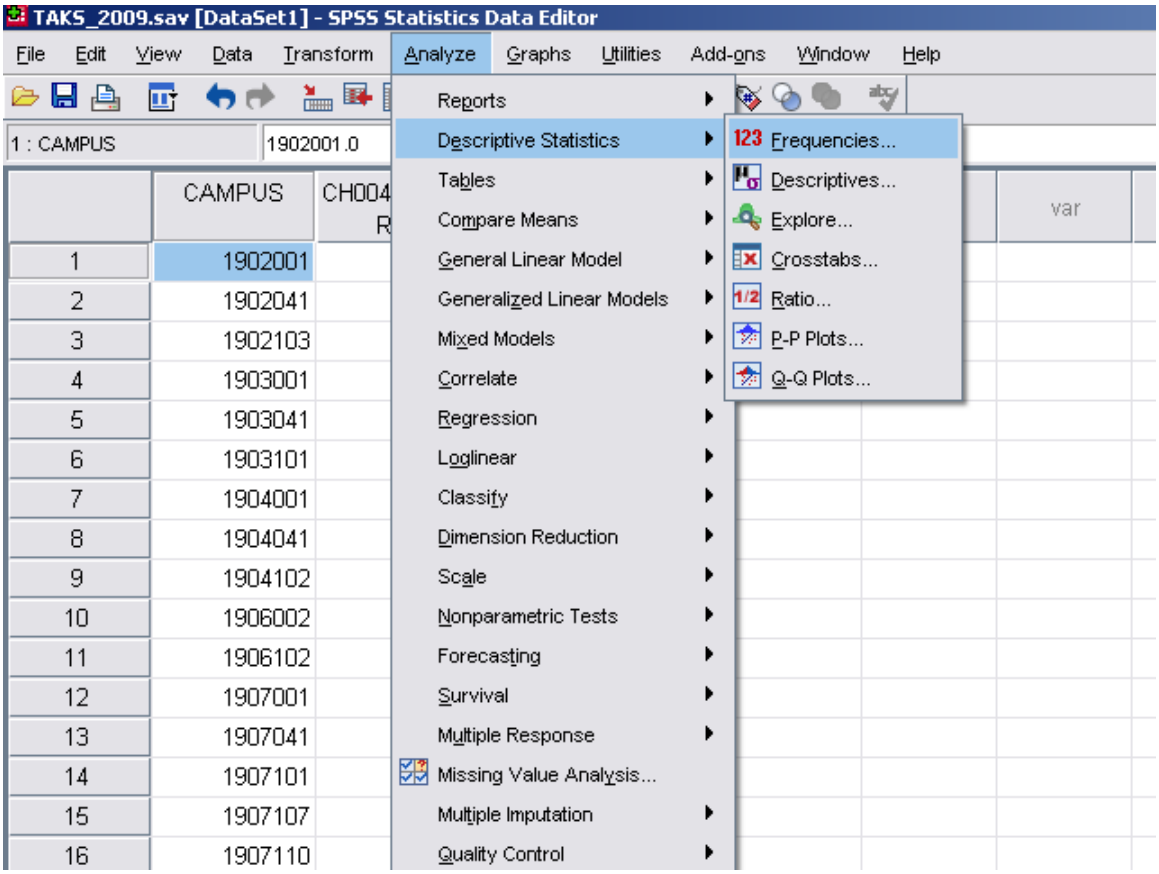
2.2 Calculating Descriptive Statistics

In this set of steps, readers are provided with directions on calculating basic measures of central tendency (i.e., mean, median, and mode), measures of dispersion (i.e., standard deviation, variance, and range), and measures of normality (i.e., skewness and kurtosis). For detailed information regarding the advantages and limitations of each of the measures cited, readers are referred to the Hyperstats Online Statistics Textbook at http://davidmlane.com/hyperstat/[9] or to the *Electronic Statistics Textbook* (2011) at http://www.statsoft.com/textbook/[10]

Step One

First check the accuracy of your dataset.
√ Analyze
* Descriptive Statistics
* Frequencies

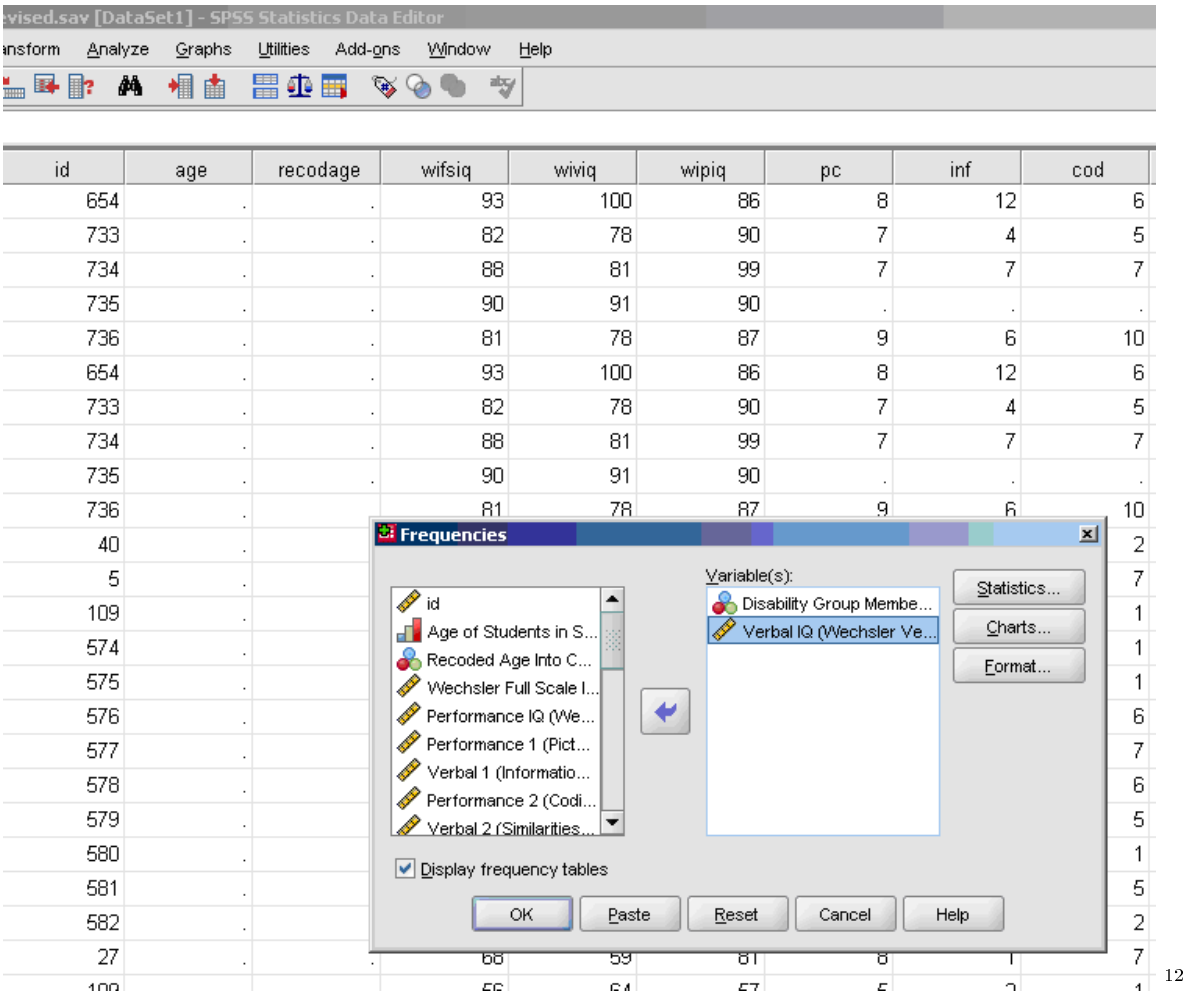
[5] http://cnx.org/content/m37276/latest/www.writingandstatisticalhelp.com
[6] http://www.ncpeapublications.org
[7] http://ncpeapublications.org/about-elr.html
[8] http://cnx.org/content/col10606/latest/
[9] http://davidmlane.com/hyperstat/
[10] http://www.statsoft.com/textbook/



11

√ Move over the independent variable/s
√ Move over the dependent variable/s
√ OK

[11] http://cnx.org/content/m37276/latest/figure1.1-thumb.png/image



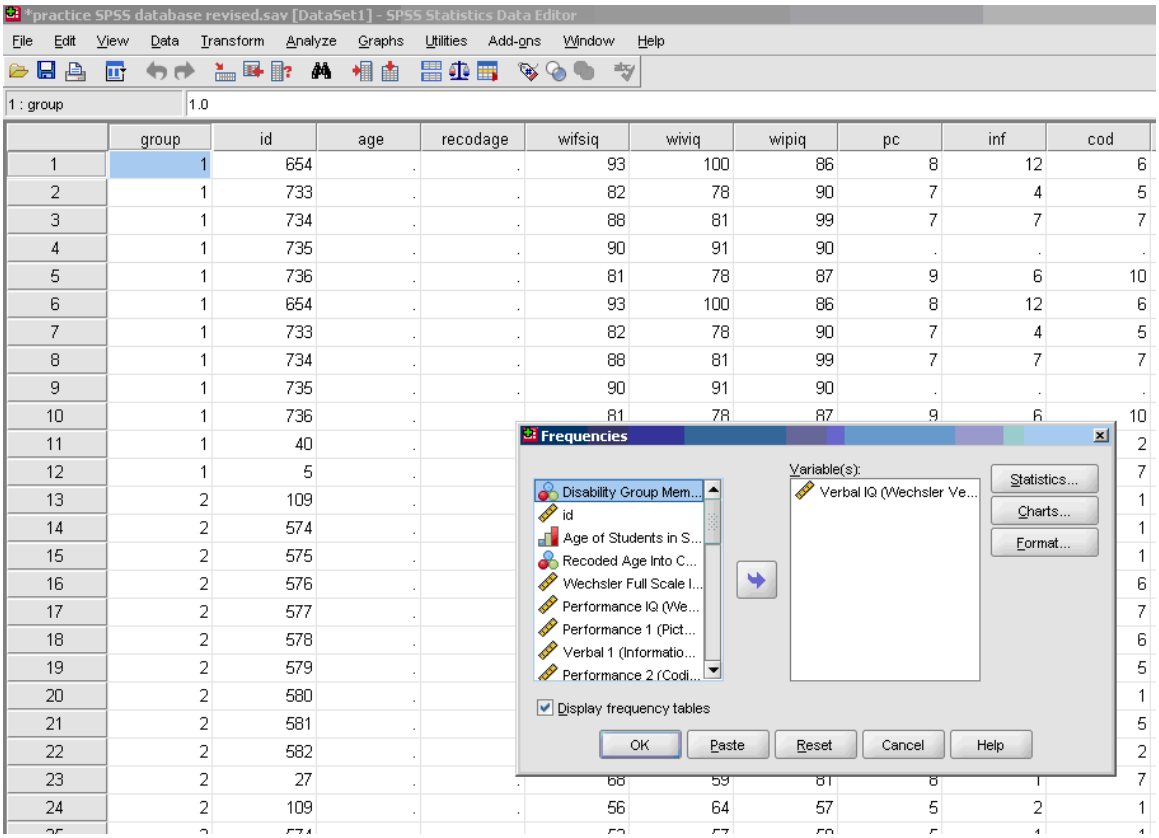
[12]

* Uncheck the display "frequency tables" so that you are not provided with the frequencies of your data every time descriptive statistics are obtained.

Now check your output to see that the values for each of the variables is within the possible limits (e.g., 1 and 2 for gender). If your dataset is inaccurate, correct any inaccuracies before calculating any statistics.

To calculate descriptive statistics:
√ Analyze
* Descriptive Statistics
* Frequencies
* Move over the dependent variable/s
* Do **NOT** move over the independent variable/s or any string variables
* Statistics

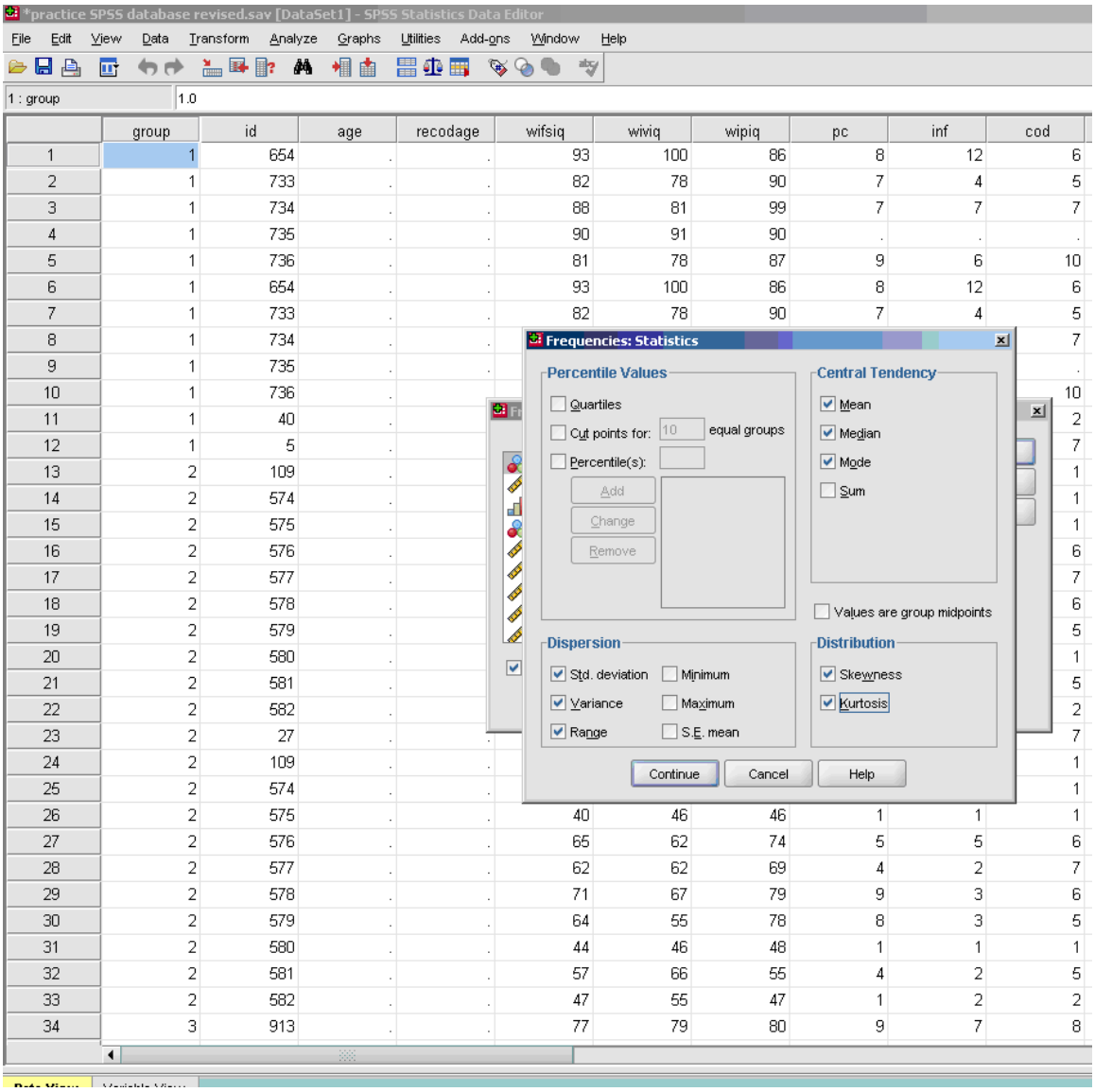
[12] http://cnx.org/content/m37276/latest/figure1.2.PNG/image



[13]

* Three basic measures of central tendency, upper right part of screen: mean, median, and mode.
* Three basic measures of variability, bottom left part of screen: variance, Standard Deviation, and range.
* Skewness [Note. Skewness refers to the extent to which the data are normally distributed around the mean. Skewed data involve having either mostly high scores with a few low ones or having mostly low scores with a few high ones.] Readers are referred to the following sources for a more detailed definition of skewness: http://www.statistics.com/index.php?page=glossary&term_id=356[14] and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[15]
* Kurtosis [Note. Kurtosis also refers to the extent to which the data are normally distributed around the mean. This time, the data are piled up higher than normal around the mean or piled up higher than normal at the ends of the distribution.] Readers are referred to the following sources for a more detailed definition of kurtosis: http://www.statistics.com/index.php?page=glossary&term_id=326[16] and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[17]

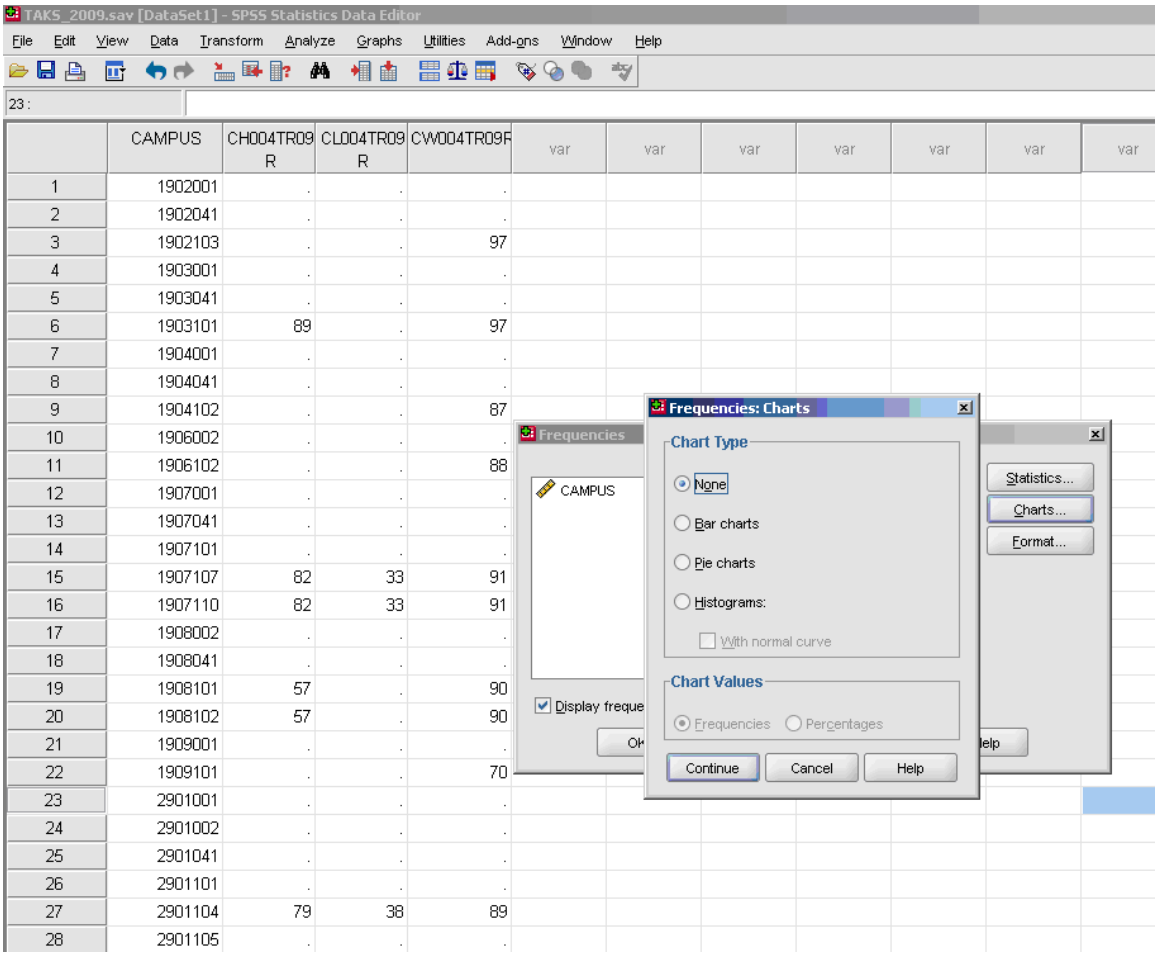
[13] http://cnx.org/content/m37276/latest/figure1.3.PNG/image
[14] http://www.statistics.com/index.php?page=glossary&term_id=356
[15] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[16] http://www.statistics.com/index.php?page=glossary&term_id=326
[17] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb



[18]

* Charts (optional, use only if you want a visual depiction of your data)
* Histograms (optional, use only if you want a visual depiction of your data)with normal curve

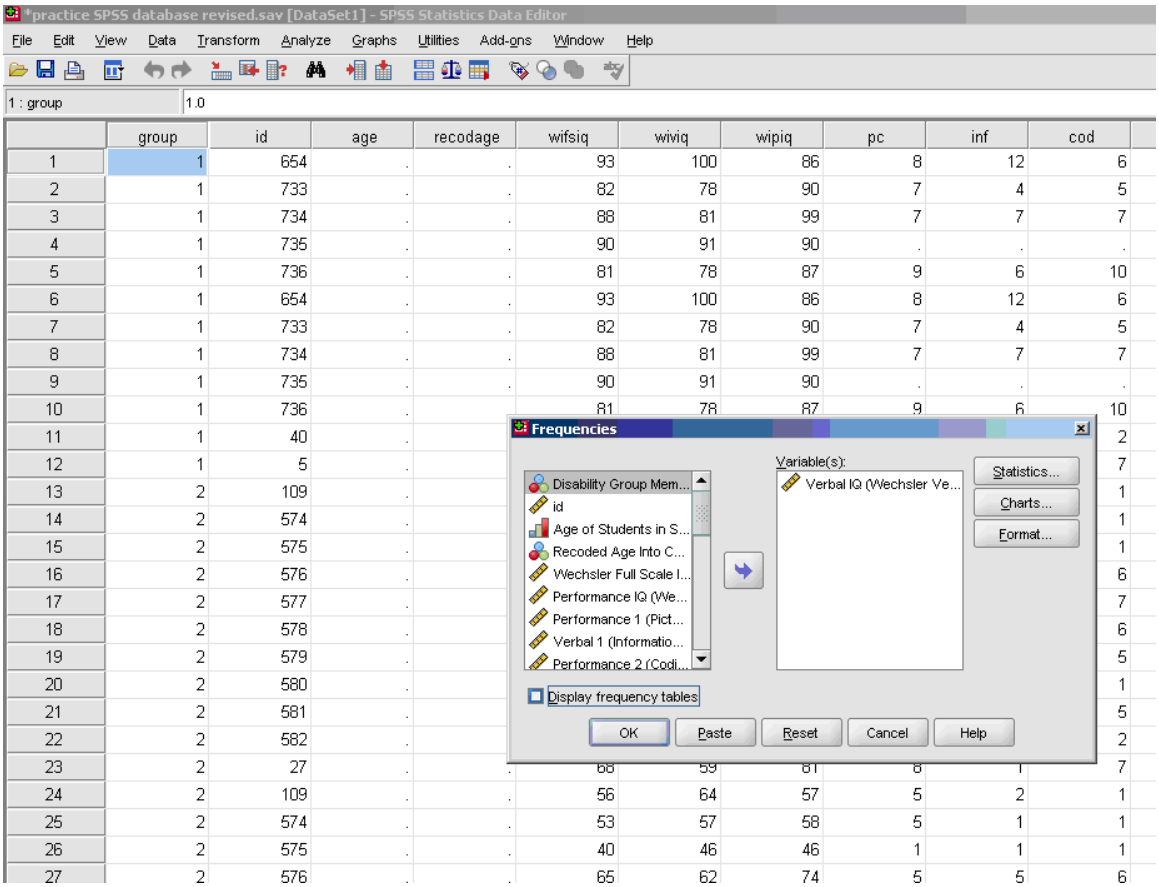
[18] http://cnx.org/content/m37276/latest/figure1.4.PNG/image



[19]

* Uncheck the display frequency tables so that you are not provided with the frequencies of your data every time descriptive statistics are obtained.
* OK

[19] http://cnx.org/content/m37276/latest/figure1.5.PNG/image

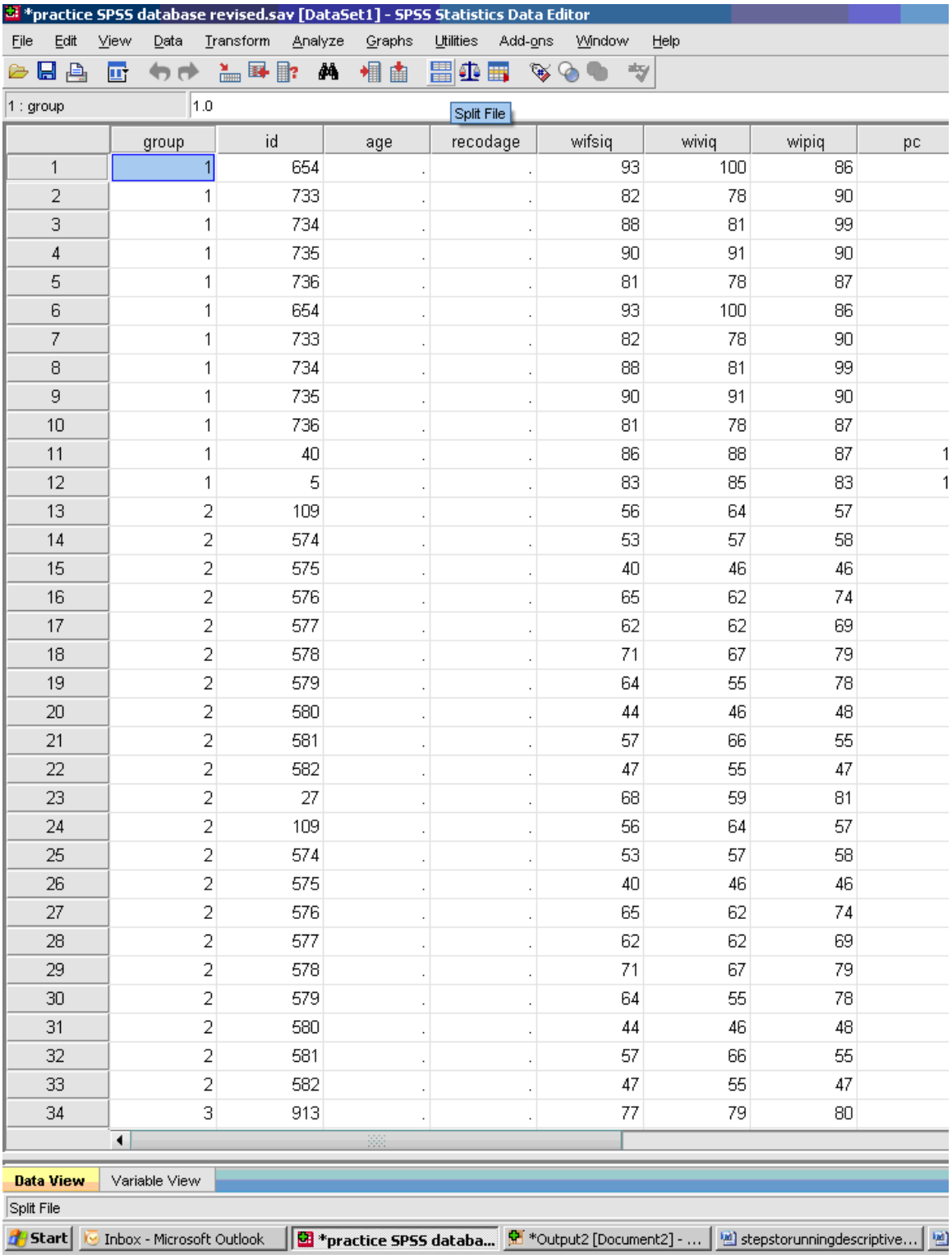


[20]

To obtain descriptive statistics for subgroups, do the following:

* Split File (icon middle top of screen next to the scales)

[20] http://cnx.org/content/m37276/latest/figure1.6.PNG/image

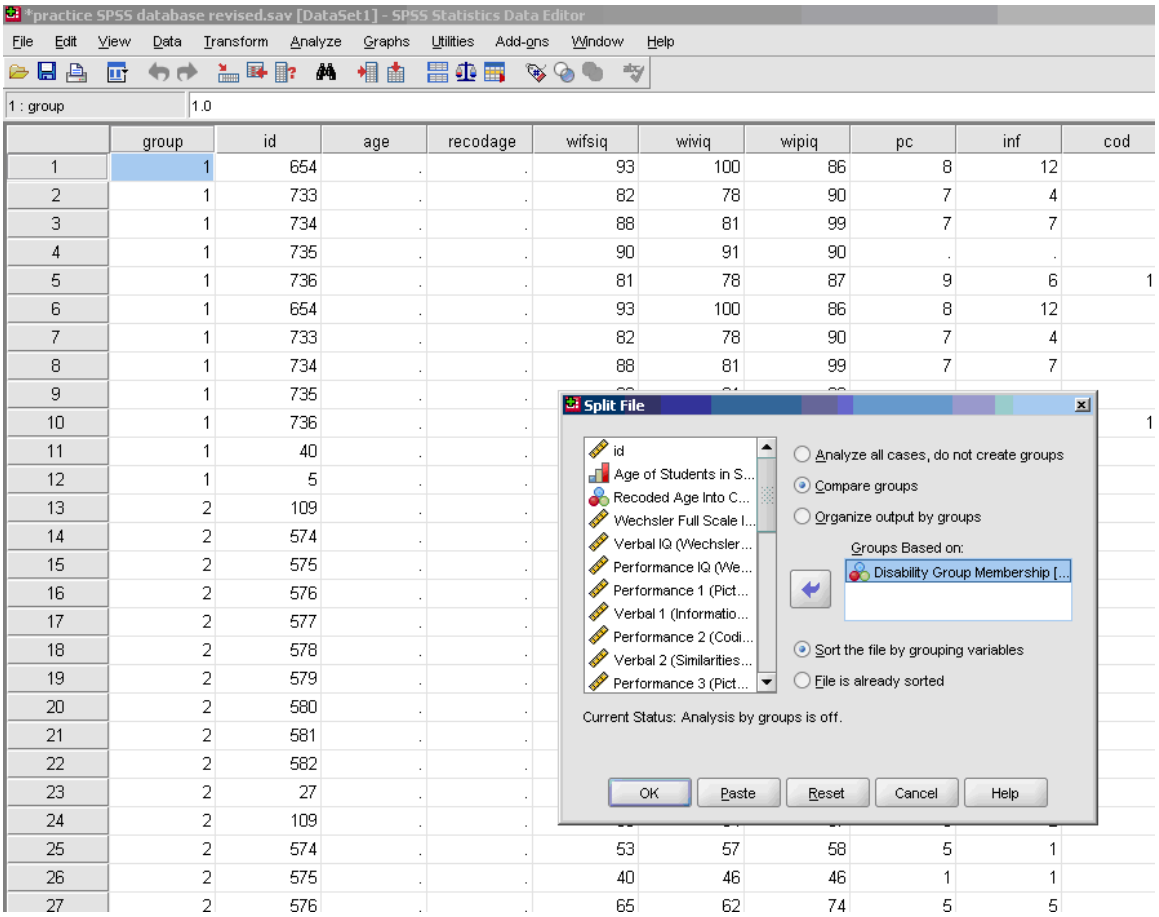


	group	id	age	recodage	wifsiq	wiviq	wipiq	pc
1	1	654	.	.	93	100	86	
2	1	733	.	.	82	78	90	
3	1	734	.	.	88	81	99	
4	1	735	.	.	90	91	90	
5	1	736	.	.	81	78	87	
6	1	654	.	.	93	100	86	
7	1	733	.	.	82	78	90	
8	1	734	.	.	88	81	99	
9	1	735	.	.	90	91	90	
10	1	736	.	.	81	78	87	
11	1	40	.	.	86	88	87	1
12	1	5	.	.	83	85	83	1
13	2	109	.	.	56	64	57	
14	2	574	.	.	53	57	58	
15	2	575	.	.	40	46	46	
16	2	576	.	.	65	62	74	
17	2	577	.	.	62	62	69	
18	2	578	.	.	71	67	79	
19	2	579	.	.	64	55	78	
20	2	580	.	.	44	46	48	
21	2	581	.	.	57	66	55	
22	2	582	.	.	47	55	47	
23	2	27	.	.	68	59	81	
24	2	109	.	.	56	64	57	
25	2	574	.	.	53	57	58	
26	2	575	.	.	40	46	46	
27	2	576	.	.	65	62	74	
28	2	577	.	.	62	62	69	
29	2	578	.	.	71	67	79	
30	2	579	.	.	64	55	78	
31	2	580	.	.	44	46	48	
32	2	581	.	.	57	66	55	
33	2	582	.	.	47	55	47	
34	3	913	.	.	77	79	80	

[21]

* Compare Groups
* Click on group (typically dichotomous in nature) and move to empty cell.

[21] http://cnx.org/content/m37276/latest/figure1.7.PNG/image

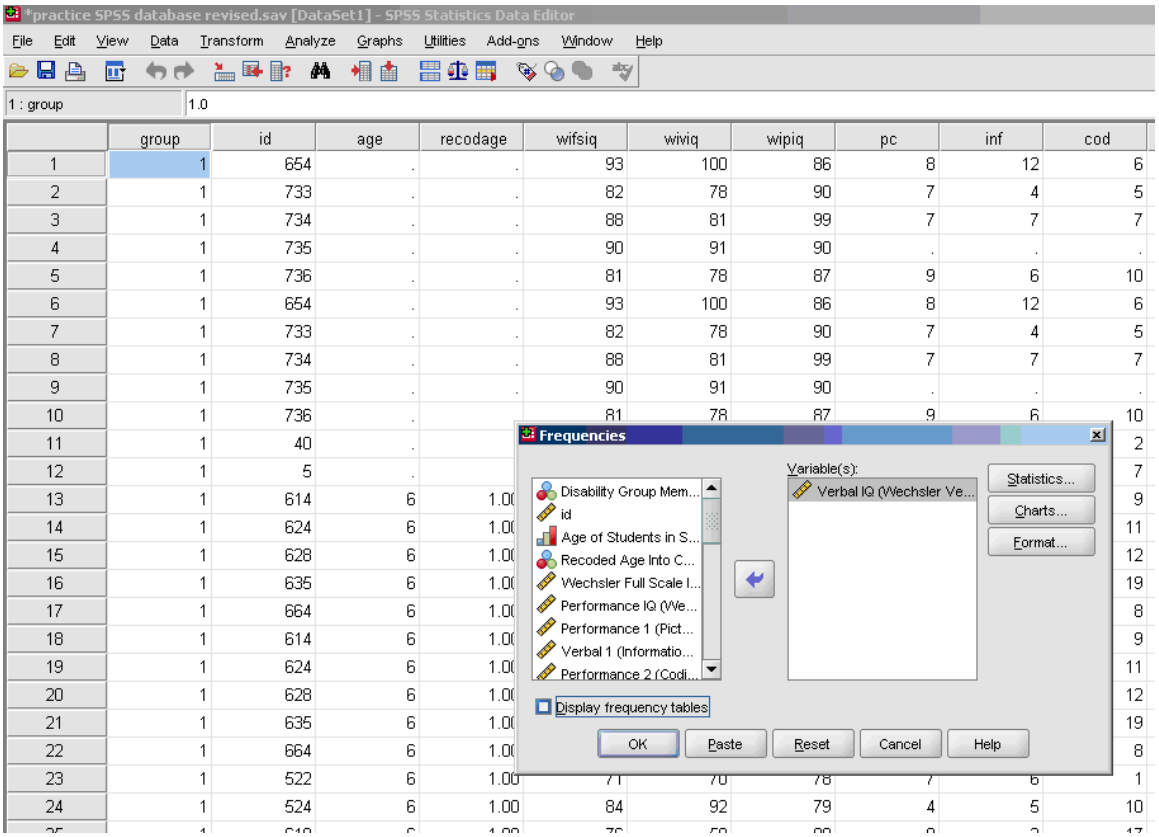


[22]

* OK

√ Analyze
* Descriptive Statistics
* Frequencies
* Move over the dependent variable/s
* Do **NOT** move over the independent variable/s or any string variables

[22] http://cnx.org/content/m37276/latest/figure1.8.PNG/image



[23]

√ Statistics

* Three basic measures of central tendency, upper right part of screen: mean, median, and mode.
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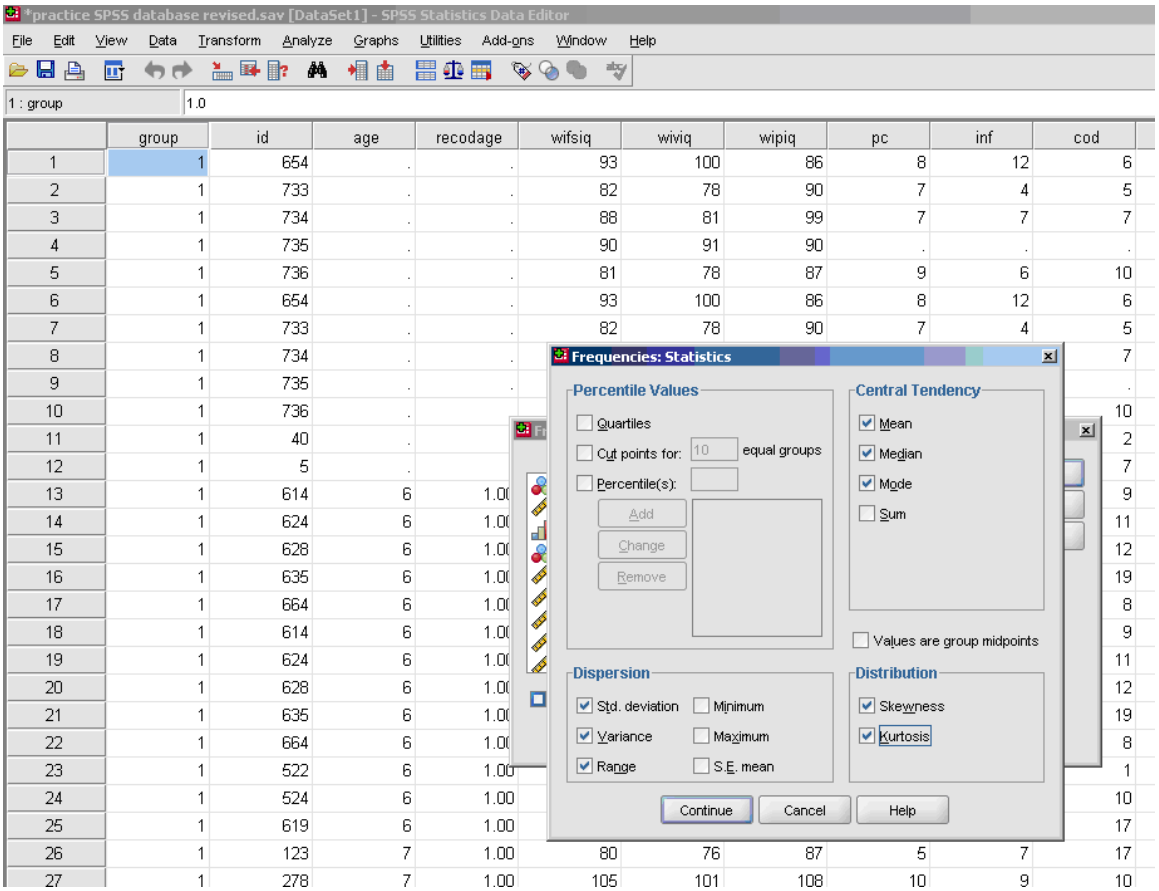
* Kurtosis [Note. Kurtosis also refers to the extent to which the data are normally distributed around the mean. This time, the data are piled up higher than normal around the mean or piled up higher than normal at the ends of the distribution.] Readers are referred to the following sources for a more detailed definition of kurtosis: http://www.statistics.com/index.php?page=glossary&term_id=326[26] and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[27]

* Continue

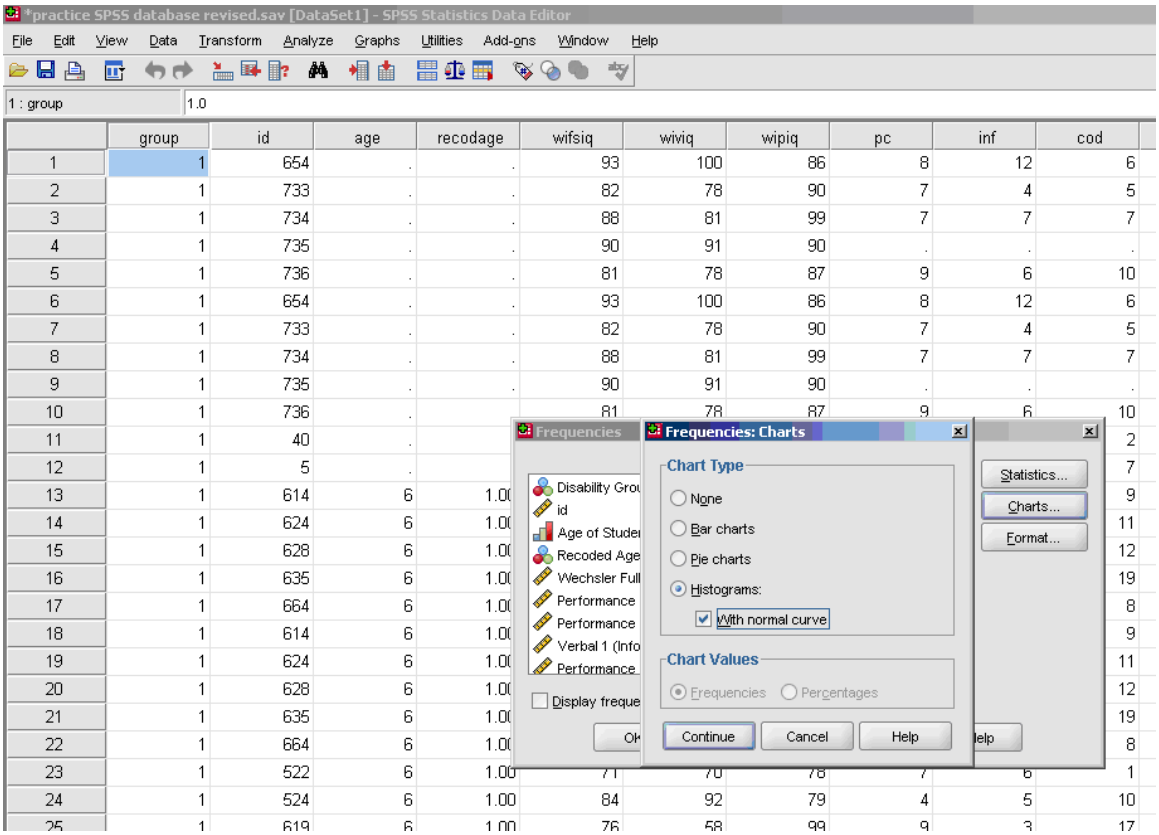
[23] http://cnx.org/content/m37276/latest/figure1.9.PNG/image
[24] http://www.statistics.com/index.php?page=glossary&term_id=356
[25] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[26] http://www.statistics.com/index.php?page=glossary&term_id=326
[27] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb



[28]

* Charts (optional, use only if you want a visual depiction of your data)
* Histograms (optional, use only if you want a visual depiction of your data)with normal curve

[28] http://cnx.org/content/m37276/latest/figure1.10.PNG/image



[29]

* OK

To calculate a z-score for any continuous variable:

√ Analyze

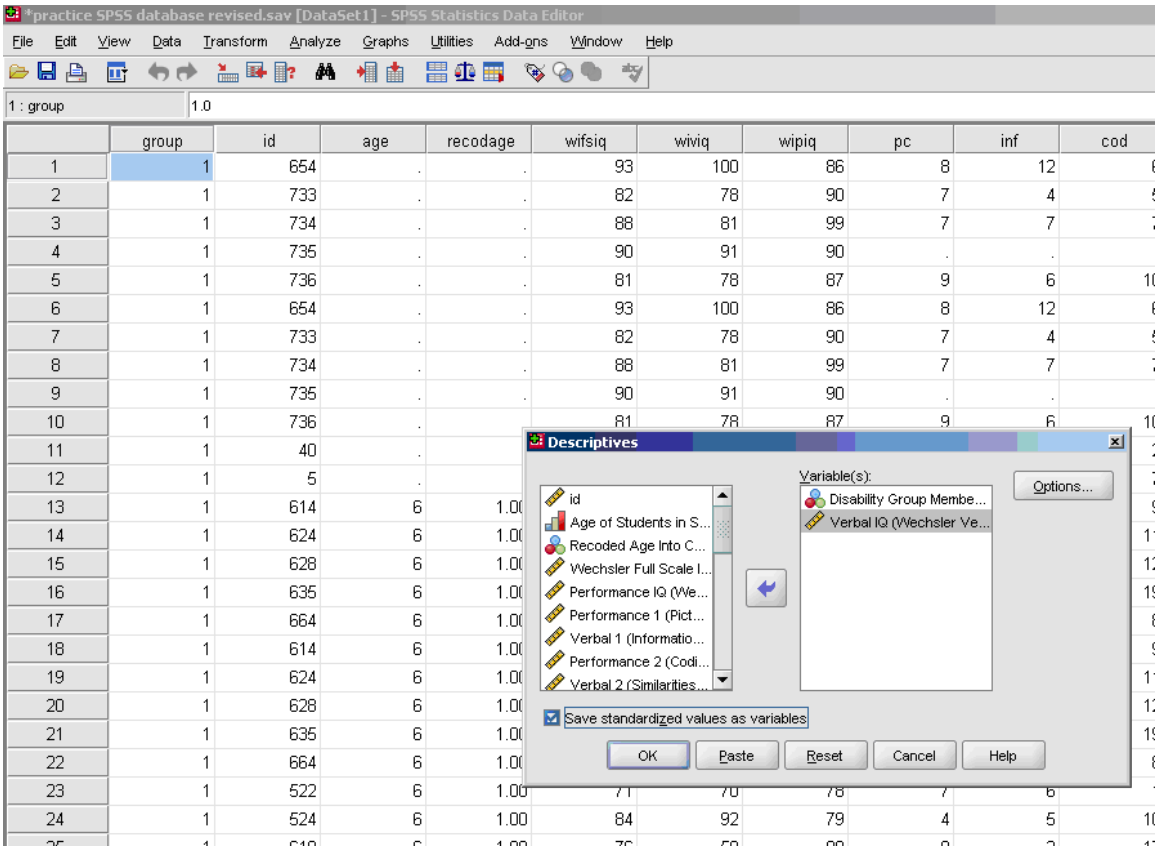
* Descriptive Statistics

* Descriptives

* Send variable on which you want z-scores to be calculated to empty cell

* Check box for Save standardized values as variables

[29] http://cnx.org/content/m37276/latest/figure1.11.PNG/image



[30]

* OK
* You will be sent to the output window, as shown in Table 1. [Note. In some versions of SPSS, you will not be sent to the output window, but will remain in the data window.] The information in the output window is not relevant for your purposes. To see the variable that was just created, go to the SPSS data. The far right column should now be the new *z*-score variable that was created.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Verbal IQ (Wechsler Verbal Intelligence 3)	1182	46	129	77.97	13.661
Valid N (listwise)	1182				

Table 2.1: Descriptive Statistics

* A new variable/s will have been generated for you in the data window

To get this information in a usable output form, do the following:

√ Analyze
* Descriptive Statistics
* Frequencies
* Move over the newly created *z*-score variable(s) (*z*-scores will generally appear at the bottom of your list with the words: "Zscore: Verbal IQ (Wechsler Verbal Intelligence 3)

[30] http://cnx.org/content/m37276/latest/figure1.12.PNG/image

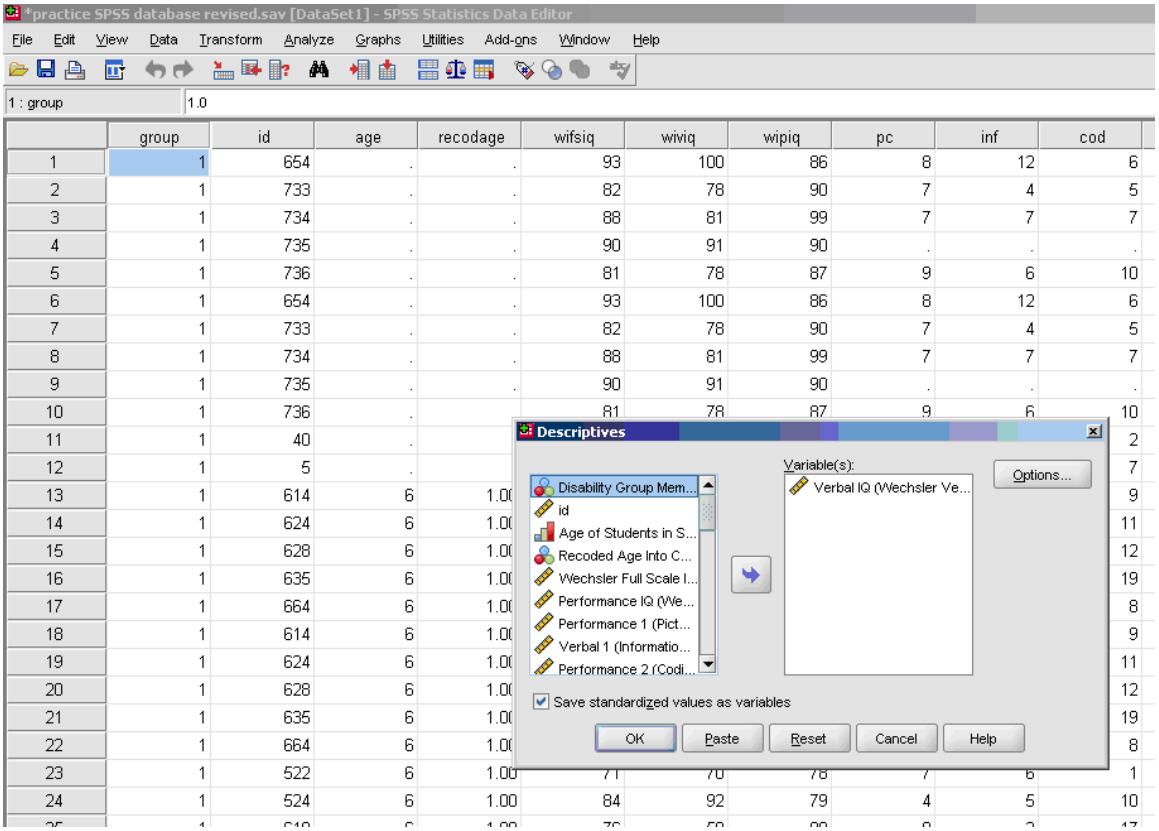
* Make sure the frequencies box is checked
* OK

* Copy or cut the frequency table for this z-score variable and carry it into WORD. Delete any irrelevant information.

		Zscore: Verbal IQ (Wechsler Verbal Intelligence 3)	Zscore(wiviq) Verbal IQ (Wechsler Verbal Intelligence 3)
N	Valid	1182	1182
	Missing	0	0

Table 2.2: Z Scores

To calculate a T-score for any continuous variable:
√ Analyze
* Descriptive Statistics
* Descriptives
* Send variable on which you want T scores to be calculated to empty cell
* Check box for Save standardized values as variables



[31]

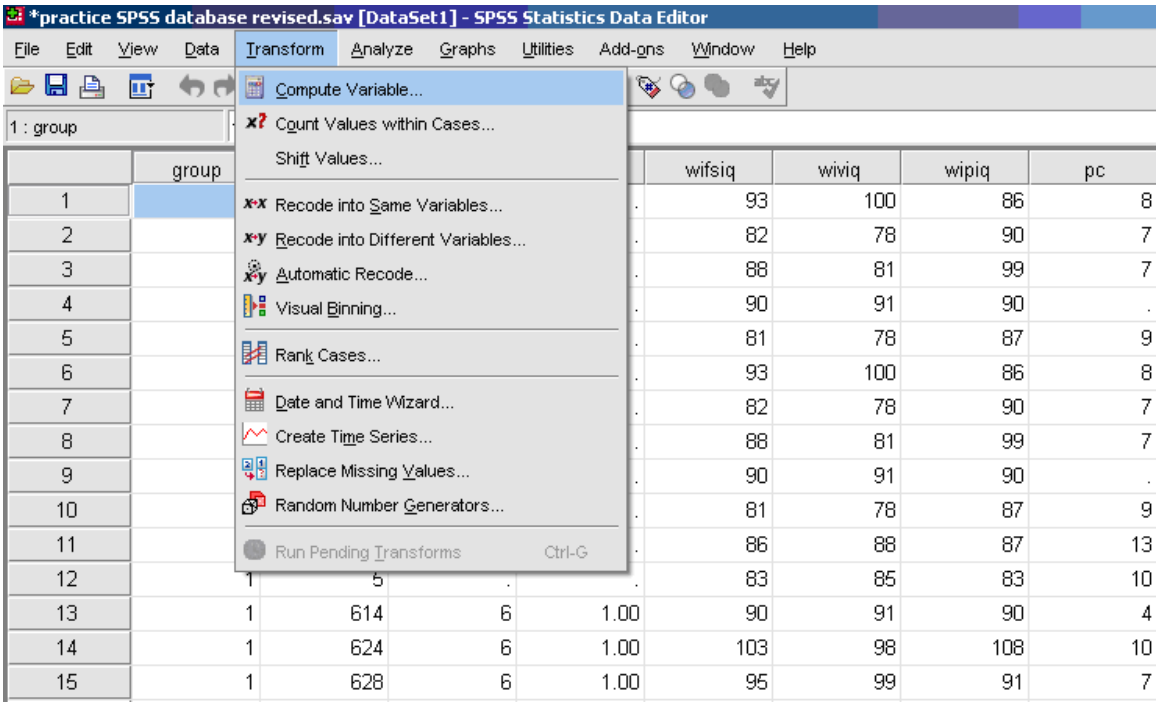
[31] http://cnx.org/content/m37276/latest/figure1.13.PNG/image

* OK
* You will be sent to the output window. Nothing in the output window is helpful. Go to the SPSS data screen by clicking on the data button bottom of screen. A new variable(s) will have been generated for you. This variable will be inserted into a formula so that you can have T scores.
* Variable view window

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Verbal IQ (Wechsler Verbal Intelligence 3)	1182	46	129	77.97	13.661
Valid N (listwise)	1182				

Table 2.3: Descriptive Statistics

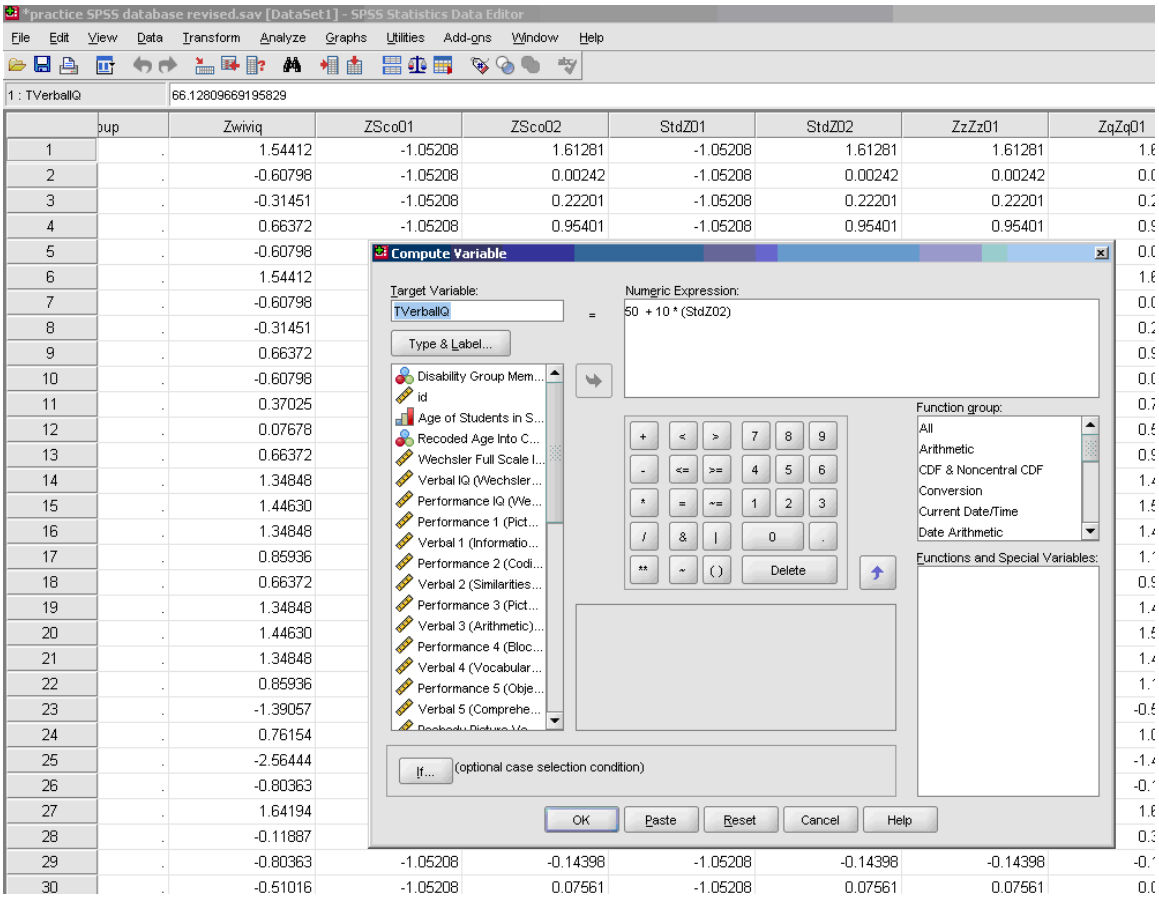
√ Create a new variable for your T score variable
* Data view window
* Transform
* Compute Variable



[32]

* Name your target variable the name you just generated for your T score variable
* In the numeric expression window, type:
* 50 + (10 x [name of the z-score variable generated by the computer earlier])

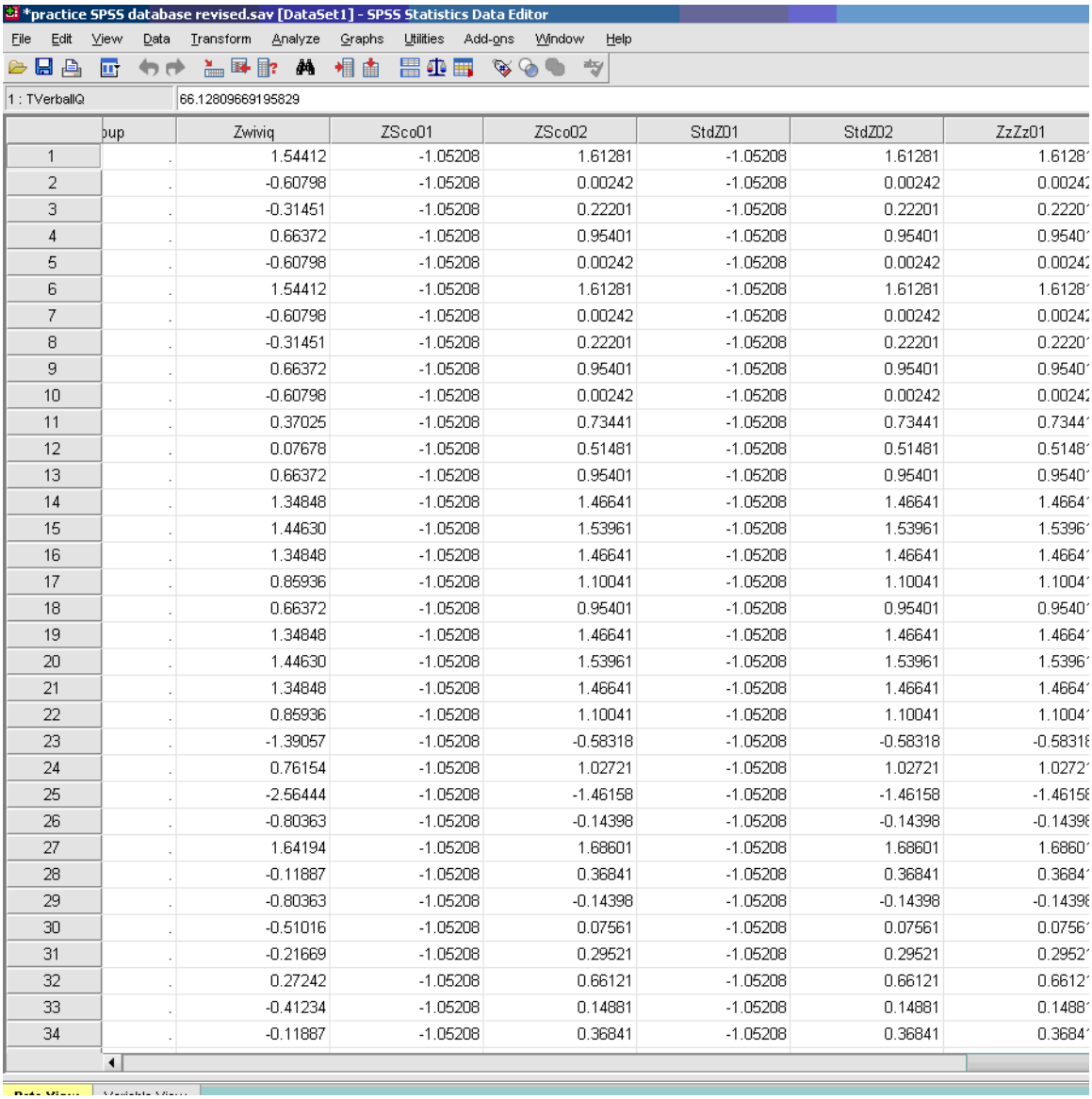
[32] http://cnx.org/content/m37276/latest/figure1.14.PNG/image



33

* OK

[33] http://cnx.org/content/m37276/latest/figure1.15.PNG/image



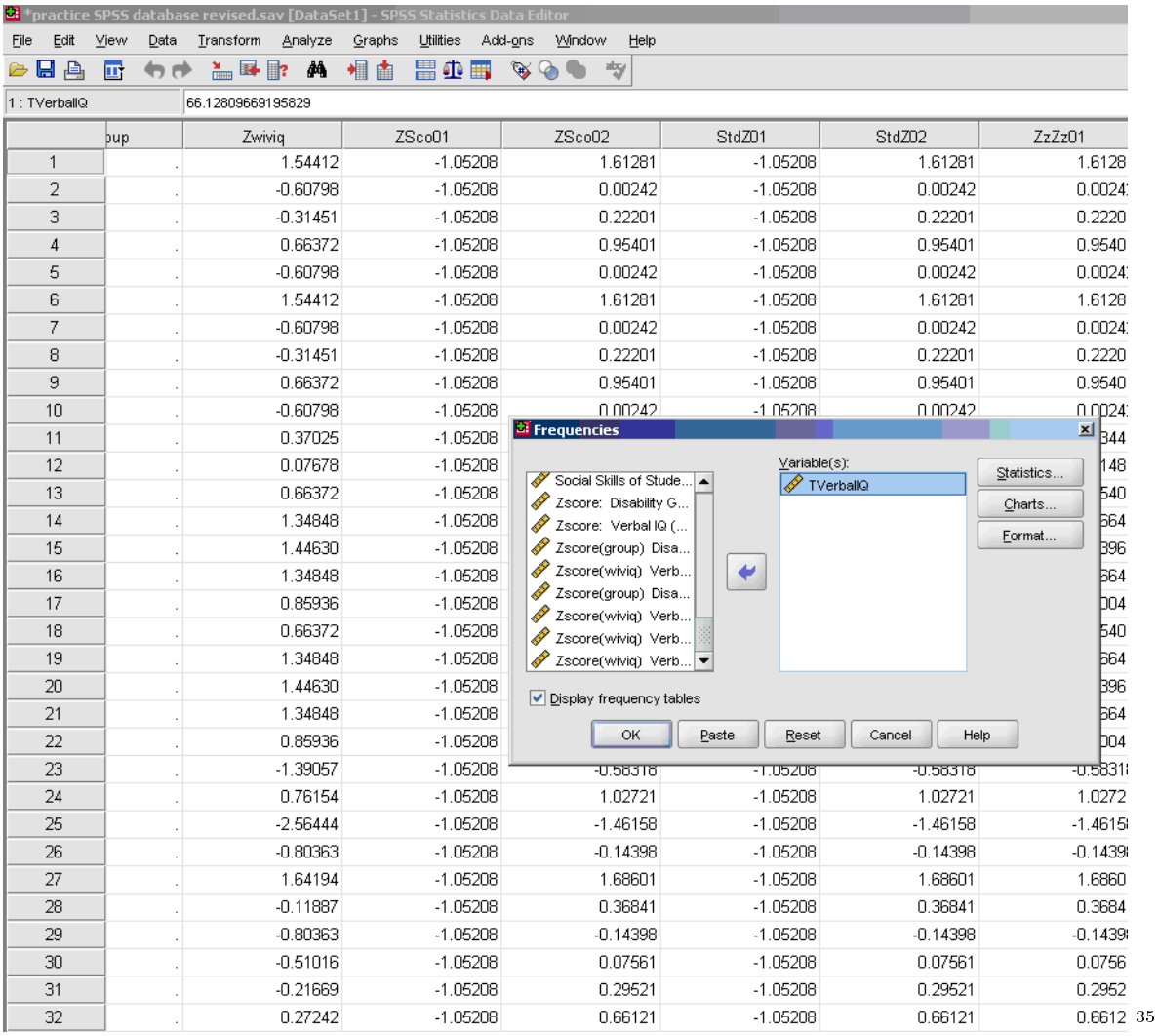
	bup	Zwiviq	ZSco01	ZSco02	StdZ01	StdZ02	ZzZz01
1	.	1.54412	-1.05208	1.61281	-1.05208	1.61281	1.6128
2	.	-0.60798	-1.05208	0.00242	-1.05208	0.00242	0.0024
3	.	-0.31451	-1.05208	0.22201	-1.05208	0.22201	0.2220
4	.	0.66372	-1.05208	0.95401	-1.05208	0.95401	0.9540
5	.	-0.60798	-1.05208	0.00242	-1.05208	0.00242	0.0024
6	.	1.54412	-1.05208	1.61281	-1.05208	1.61281	1.6128
7	.	-0.60798	-1.05208	0.00242	-1.05208	0.00242	0.0024
8	.	-0.31451	-1.05208	0.22201	-1.05208	0.22201	0.2220
9	.	0.66372	-1.05208	0.95401	-1.05208	0.95401	0.9540
10	.	-0.60798	-1.05208	0.00242	-1.05208	0.00242	0.0024
11	.	0.37025	-1.05208	0.73441	-1.05208	0.73441	0.7344
12	.	0.07678	-1.05208	0.51481	-1.05208	0.51481	0.5148
13	.	0.66372	-1.05208	0.95401	-1.05208	0.95401	0.9540
14	.	1.34848	-1.05208	1.46641	-1.05208	1.46641	1.4664
15	.	1.44630	-1.05208	1.53961	-1.05208	1.53961	1.5396
16	.	1.34848	-1.05208	1.46641	-1.05208	1.46641	1.4664
17	.	0.85936	-1.05208	1.10041	-1.05208	1.10041	1.1004
18	.	0.66372	-1.05208	0.95401	-1.05208	0.95401	0.9540
19	.	1.34848	-1.05208	1.46641	-1.05208	1.46641	1.4664
20	.	1.44630	-1.05208	1.53961	-1.05208	1.53961	1.5396
21	.	1.34848	-1.05208	1.46641	-1.05208	1.46641	1.4664
22	.	0.85936	-1.05208	1.10041	-1.05208	1.10041	1.1004
23	.	-1.39057	-1.05208	-0.58318	-1.05208	-0.58318	-0.5831
24	.	0.76154	-1.05208	1.02721	-1.05208	1.02721	1.0272
25	.	-2.56444	-1.05208	-1.46158	-1.05208	-1.46158	-1.4615
26	.	-0.80363	-1.05208	-0.14398	-1.05208	-0.14398	-0.1439
27	.	1.64194	-1.05208	1.68601	-1.05208	1.68601	1.6860
28	.	-0.11887	-1.05208	0.36841	-1.05208	0.36841	0.3684
29	.	-0.80363	-1.05208	-0.14398	-1.05208	-0.14398	-0.1439
30	.	-0.51016	-1.05208	0.07561	-1.05208	0.07561	0.0756
31	.	-0.21669	-1.05208	0.29521	-1.05208	0.29521	0.2952
32	.	0.27242	-1.05208	0.66121	-1.05208	0.66121	0.6612
33	.	-0.41234	-1.05208	0.14881	-1.05208	0.14881	0.1488
34	.	-0.11887	-1.05208	0.36841	-1.05208	0.36841	0.3684

[34]

* Respond yes to change existing variable
* You may be sent to the output screen. Nothing there is helpful.
* Go to data button and view your new T score variable.
* To get this information in a usable output form, do the following:

√ Analyze
* Descriptive Statistics
* Frequencies
* Move over the newly created T score variable
* Make sure the frequencies box is checked.

[34] http://cnx.org/content/m37276/latest/figure1.16.PNG/image



* OK
* Copy or cut the frequency table for this *T* score variable and carry it into WORD. Delete any irrelevant information.

2.3 Writing Up Your Statistics

So, how do you "write up" your Research Questions and your Results? Schuler W. Huck (2000) in his seminal book entitled, *Reading Statistics and Research*, points to the importance of your audience understanding and making sense of your research in written form. Huck further states:

2.3.1

This book is designed to help people *decipher* what researchers are trying to communicate in the written or oral summaries of their investigations. Here, the goal is simply to distill meaning from the words, symbols, tables, and figures included in the research report. To be competent in this arena, one must not only be able to decipher what's presented but also to "fill in the holes"; this is the case because researchers typically

[35] http://cnx.org/content/m37276/latest/figure1.17.PNG/image

assume that those receiving the research report are familiar with unmentioned details of the research process and statistical treatment of data.

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Click here to view: *Writing Up Your Descriptive Staistics* [36]

2.4 References

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erbaum

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[36] http://cnx.org/content/col11299/latest/
[37] http://davidmlane.com/hyperstat/
[38] http://www.statistics.com/index.php?page=glossary&term_id=326
[39] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[40] http://www.statistics.com/index.php?page=glossary&term_id=356
[41] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[42] http://www.statsoft.com/textbook/

Chapter 3

Calculating a Nonparametric Pearson Chi-Square[1]

NOTE: This chapter has been peer-reviewed, accepted, and endorsed by the National Council of Professors of Educational Administration (NCPEA) as a significant contribution to the scholarship and practice of education administration. Formatted and edited in Connexions by Theodore Creighton and Brad Bizzell, Virginia Tech, Janet Tareilo, Stephen F. Austin State University, and Thomas Kersten, Roosevelt University.

3.1

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Authors Information

John R. Slate is a Professor at Sam Houston State University where he teaches Basic and Advanced Statistics courses, as well as professional writing, to doctoral students in Educational Leadership and Counseling. His research interests lie in the use of educational databases, both state and national, to reform school practices. To date, he has chaired and/or served over 100 doctoral student dissertation committees. Recently, Dr. Slate created a website (Writing and Statistical Help[4]) to assist students and faculty with both statistical assistance and in editing/writing their dissertations/theses and manuscripts.

[1] This content is available online at <http://cnx.org/content/m37277/1.5/>.
[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[3] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[4] http://cnx.org/content/m37277/latest/www.writingandstatisticalhelp

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3.2 Conducting a Nonparametric Pearson Chi-Square

In this set of steps, readers are provided with directions on calculating a statistical procedure in which the independent variable and the dependent variable are categorical variables. As such, the only descriptive statistics that can be obtained are frequencies, percentages, and sums. Because the data on which this chi-square procedure is used are grouped data, skewness and kurtosis values are not appropriate. Readers should ensure that the assumptions described in the steps below are met prior to conducting this nonparametric procedure. For more detailed information about the statistical and conceptual underpinnings of this statistical technique, readers are referred to the Hyperstats Online Statistics Textbook at http://davidmlane.com/hyperstat/chi_square.html[8] or to the *Electronic Statistics Textbook* (2011) at http://www.statsoft.com/textbook/basic-statistics/[9]

3.2.1 Step One:

Check to make sure that both variables are categorical in nature. That is, the variables must have values that are in a restricted range (e.g., 1 or 2 for gender; 1 – 5 for Strongly Agree through Strongly Disagree; 1 – 5 for ethnicity categories).

3.2.2 Step Two:

Check to verify that you have available per cell at least 5 responses (i.e., divide the sample size by the number of cells [number of categories for the IV times the number of categories for the DV] and have a value of at

[5] http://www.ncpeapublications.org
[6] http://ncpeapublications.org/about-elr.html
[7] http://cnx.org/content/col10606/latest/
[8] http://davidmlane.com/hyperstat/chi_square.html
[9] http://www.statsoft.com/textbook/basic-statistics/

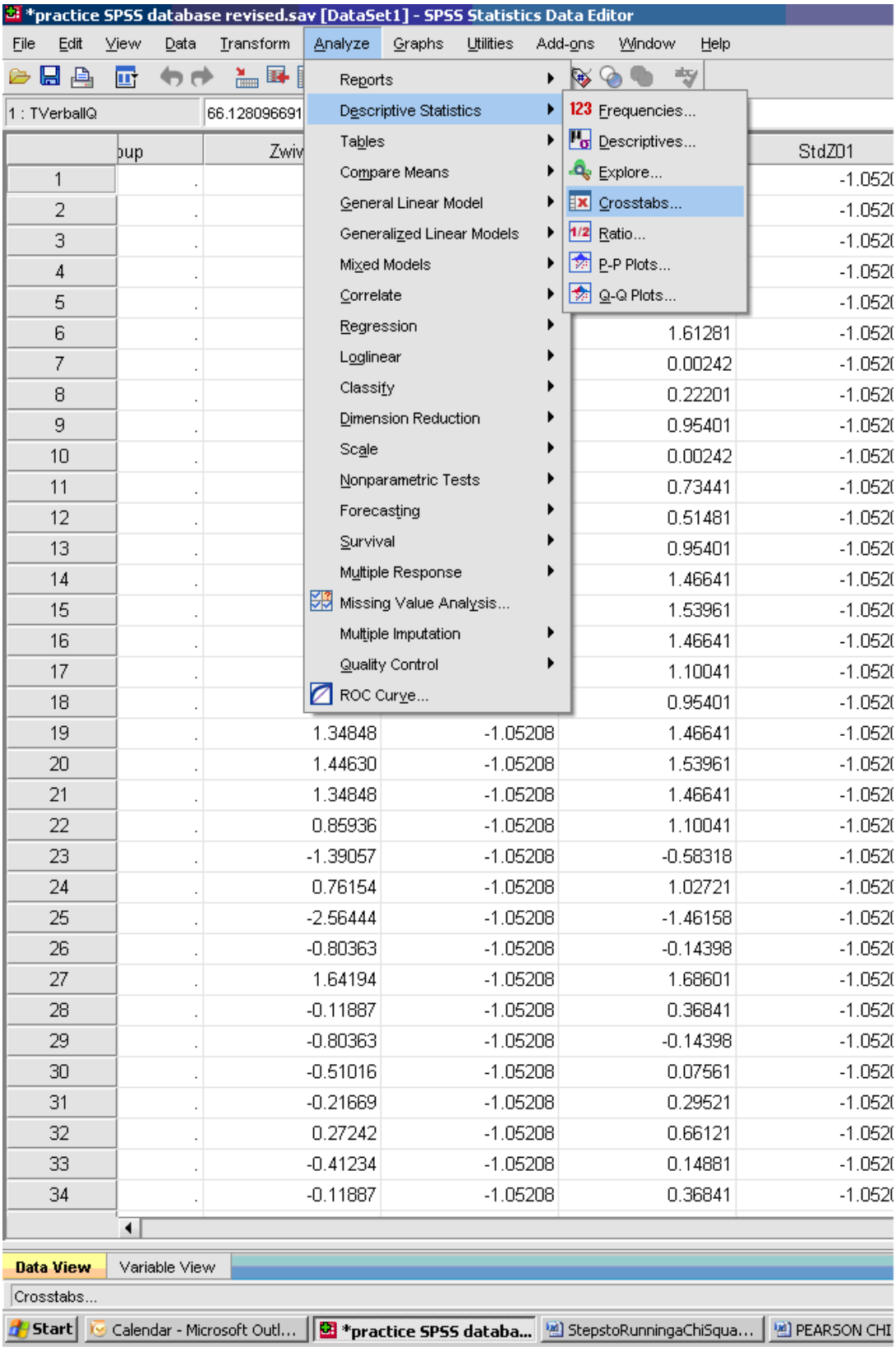
least 5).

3.2.3 Step Three:

Verify that only one response per participant is present. Once these assumptions have been checked and validated, then the Pearson chi-square procedure can be calculated.

3.2.4 Step Four:

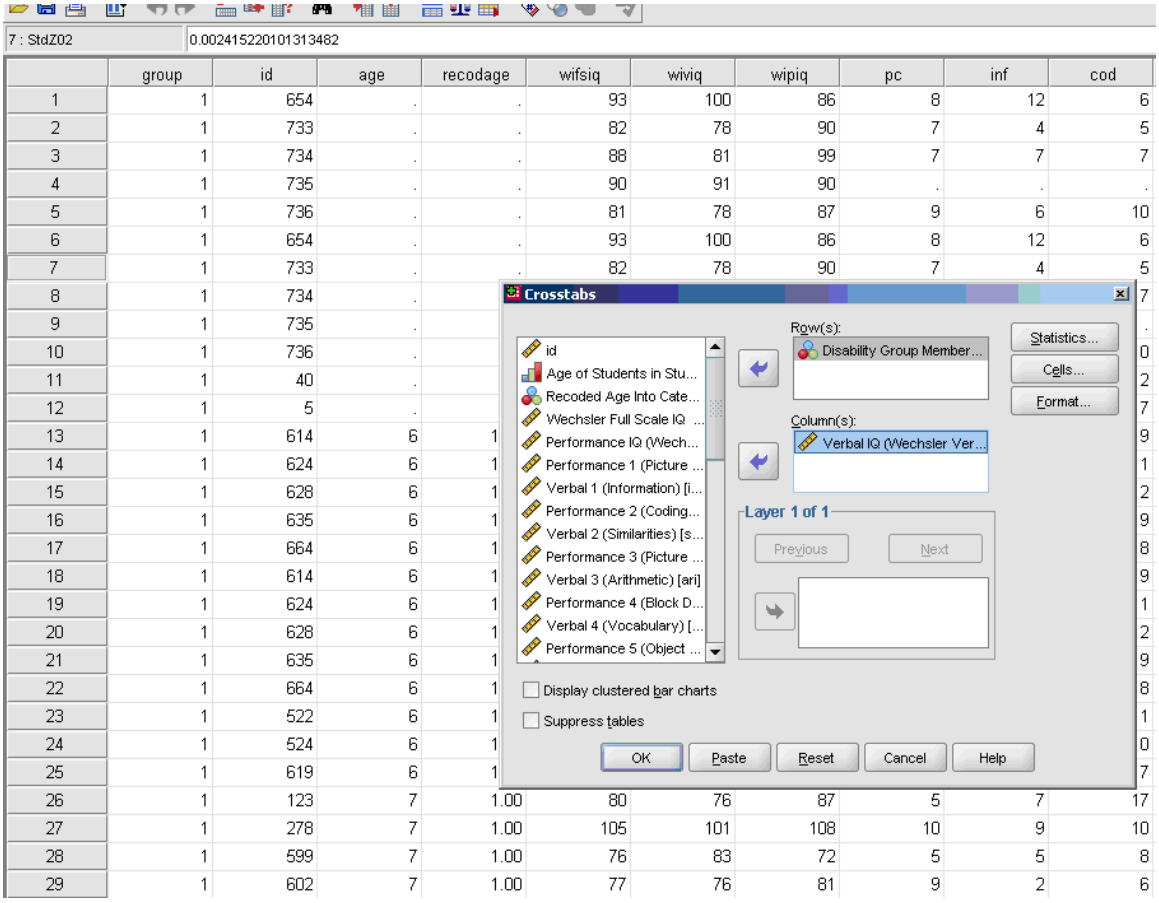
√ Analyze
* Descriptive Statistics
* Crosstabs



[10]

[10] http://cnx.org/content/m37277/latest/figure2.1.PNG/image

√ Independent Variable (e.g., gender) in Row
√ Dependent Variable (e.g., responses to a survey item) in Column

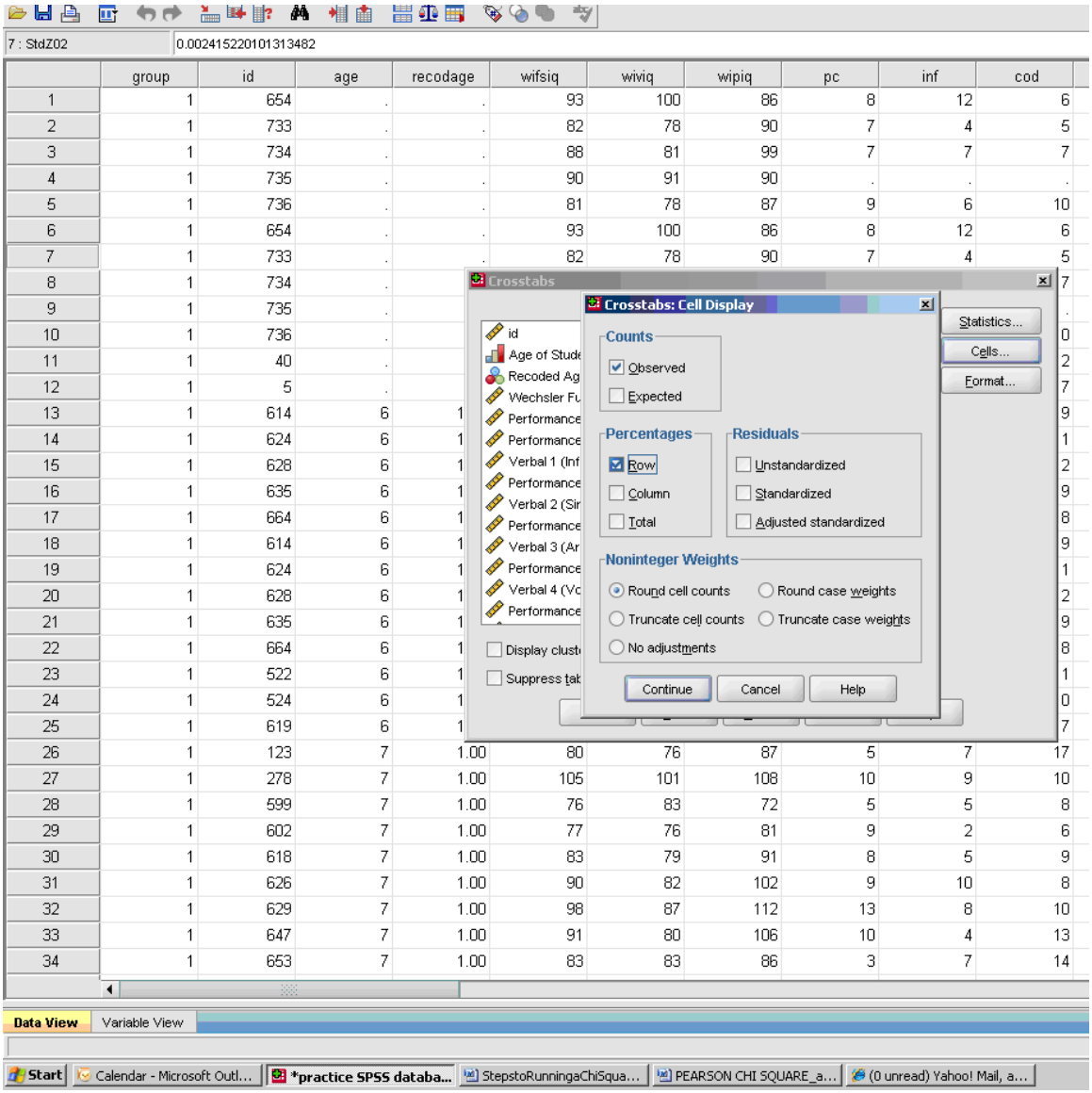


	group	id	age	recodage	wifsiq	wiviq	wipiq	pc	inf	cod
1	1	654	.	.	93	100	86	8	12	6
2	1	733	.	.	82	78	90	7	4	5
3	1	734	.	.	88	81	99	7	7	7
4	1	735	.	.	90	91	90	.	.	.
5	1	736	.	.	81	78	87	9	6	10
6	1	654	.	.	93	100	86	8	12	6
7	1	733	.	.	82	78	90	7	4	5
8	1	734	.							7
9	1	735	.							.
10	1	736	.							0
11	1	40	.							2
12	1	5	.							7
13	1	614	6	1						9
14	1	624	6	1						1
15	1	628	6	1						2
16	1	635	6	1						9
17	1	664	6	1						8
18	1	614	6	1						9
19	1	624	6	1						1
20	1	628	6	1						2
21	1	635	6	1						9
22	1	664	6	1						8
23	1	522	6	1						1
24	1	524	6	1						0
25	1	619	6	1						7
26	1	123	7	1.00	80	76	87	5	7	17
27	1	278	7	1.00	105	101	108	10	9	10
28	1	599	7	1.00	76	83	72	5	5	8
29	1	602	7	1.00	77	76	81	9	2	6

[11]

√ Cells
√ In the Percentages Box
√ Row

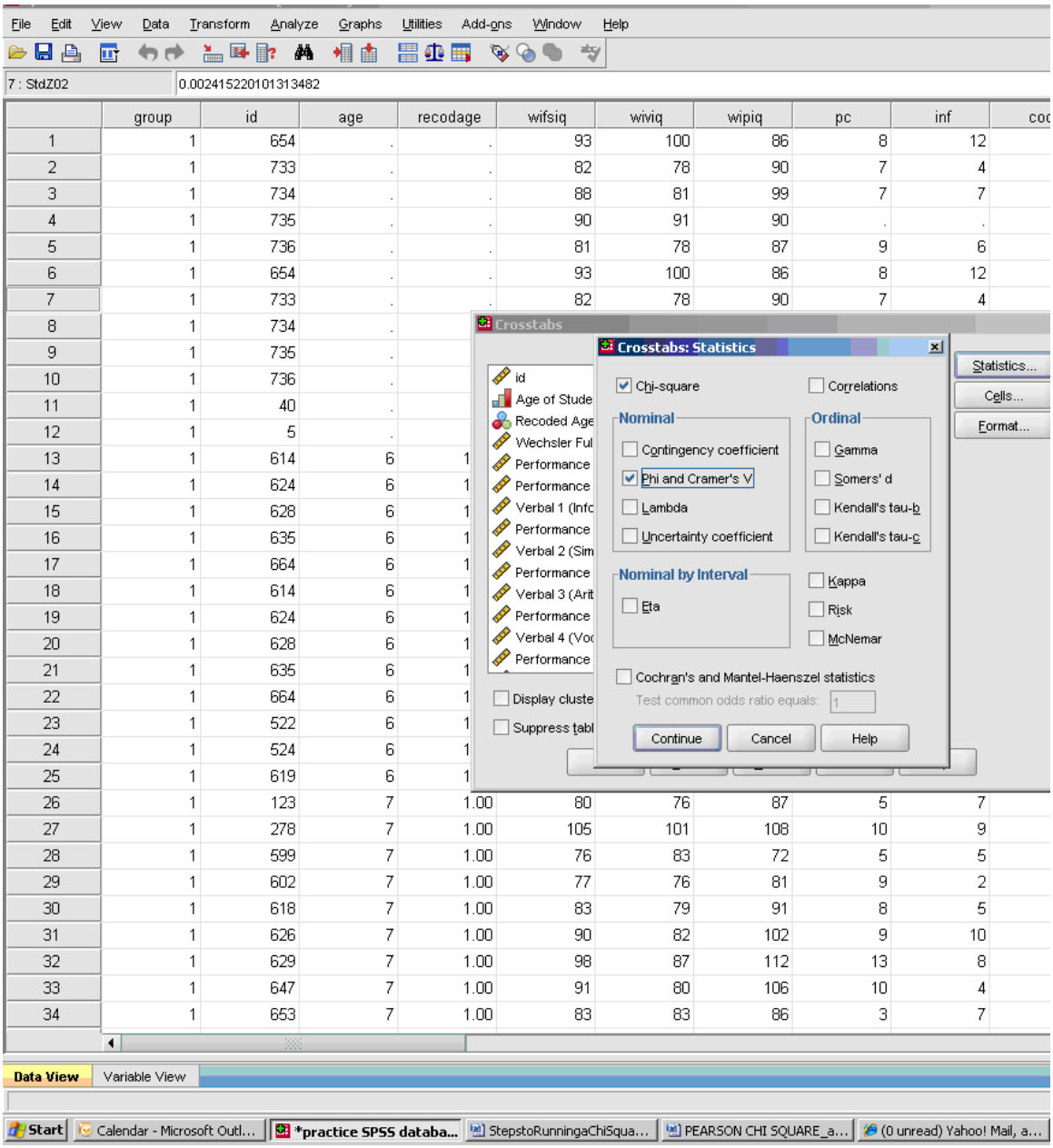
[11] http://cnx.org/content/m37277/latest/figure2.2.PNG/image



[12]

√ Continue
√ Statistics
√ Chi Square
√ Phi and Cramer's V

[12] http://cnx.org/content/m37277/latest/figure2.3.PNG/image



[13]

√ Continue
√ OK

3.2.5 Step Five:

Check for Statistical Significance

1. Go to the Chi-Square Test Box
2. Find Pearson Chi-Square row and Asymp. Sig. (2-sided) column cell

[13] http://cnx.org/content/m37277/latest/figure2.4.PNG/image

Chi-Square Tests

	Value	df	Asymp.Sig.(2-sided)
Pearson Chi-Square	833.549[a]	118	.000
Likelihood Ratio	907.609	118	.000
Linear-by-Linear	16.845	1	.000
Association			
N of Valid Cases	1182		

Table 3.1

a. 81 cells (45.0%) have expected count less than 5. The minimum expected count is .23.

3.3 Step Six:

Check Effect Size
1. Go to the Symmetric Measures Box
2. Find the Nominal by Nominal Cramer's V row and Value column cell
3. The effect size is there and must be related to Cohen (1998)

Small effect size = .10 (range of .10 to .299)
Medium effect size = .30 (range of .30 to .499)
Large effect size = .50 (range of .50 to 1.00)

NOTE: Cramer's V cannot be greater than 1.00

Symmetric Measures

	Value	Approx Sig.
Nominal by Phi	.840	.000
Nominal Cramer's V	.94	.000
N of Valid Cases	1182	

Table 3.2

3.4 Step Seven:

Numerical Sentence
1. $X^2(\text{df})_{\text{sp}} =$ $_{\text{sp}}$Pearson Chi-Square/Value Cell,$_{\text{sp}}p_{\text{sp}} <$ $_{\text{sp}}.001$
$X^2(1) = 833.55$, $p < .001$
[Note. The sp refers to a space being present where the sp is located.]

3.5 Step Eight:

1. Go to the IV by DV table (i.e., the one above the Chi-Square Tests table)
2. Examine the percentages to determine where the statistically significant differences are

3.6 Step Nine:

Narrative and Interpretation Outline

1. Let the reader know what statistical procedure was conducted.
2. Explain how the assumptions for this statistical procedure were met.
3. Report the results from the test
4. Interpret the findings

3.7 Writing Up Your Statistics

So, how do you "write up" your Research Questions and your Results? Schuler W. Huck (2000) in his seminal book entitled, *Reading Statistics and Research*, points to the importance of your audience understanding and making sense of your research in written form. Huck further states:

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Click here to view: *Writing Up Your Chi-square Staistics* [14]

3.8 References

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[14] http://cnx.org/content/col11299/latest/
[15] http://davidmlane.com/hyperstat/
[16] http://www.statistics.com/index.php?page=glossary&term_id=326
[17] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[18] http://www.statistics.com/index.php?page=glossary&term_id=356
[19] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[20] http://www.statsoft.com/textbook/

Chapter 4

Calculating Correlations: Parametric and Non Parametric[1]

NOTE: This Chapter has been peer-reviewed, accepted, and endorsed by the National Council of Professors of Educational Administration (NCPEA) as a significant contribution to the scholarship and practice of education administration. Formatted and edited in Connexions by Theodore Creighton and Brad Bizzell, Virginia Tech, Janet Tareilo, Stephen F. Austin State University, and Thomas Kersten, Roosevelt University.

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[1] This content is available online at <http://cnx.org/content/m37278/1.7/>.
[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[3] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[4] http://www.writingandstatisticalhelp.com

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4.2 Calculating Correlations: Parametric and Nonparametric

In this set of steps, readers will calculate either a parametric or a nonparametric statistical analysis, depending on whether the data reflect a normal distribution. A parametric statistical procedure requires that its data be reflective of a normal curve whereas no such assumption is made in the use of a nonparametric procedure. Of the two types of statistical analyses, the parametric procedure is the more powerful one in ascertaining whether or not a statistically significant relationship, in this case, exists. As such, parametric procedures are preferred over nonparametric procedures. When data are not normally distributed, however, parametric analyses may provide misleading and inaccurate results. Accordingly, nonparametric analyses should be used in cases where data are not reflective of a normal curve. In this set of steps, readers are provided with information on how to make the determination of normally or nonnormally distributed data. For detailed information regarding the assumptions underlying parametric and nonparametric procedures, readers are referred to the Hyperstats Online Statistics Textbook at http://davidmlane.com/hyperstat/[9] or to the *Electronic Statistics Textbook* (2011) at http://www.statsoft.com/textbook/[10]

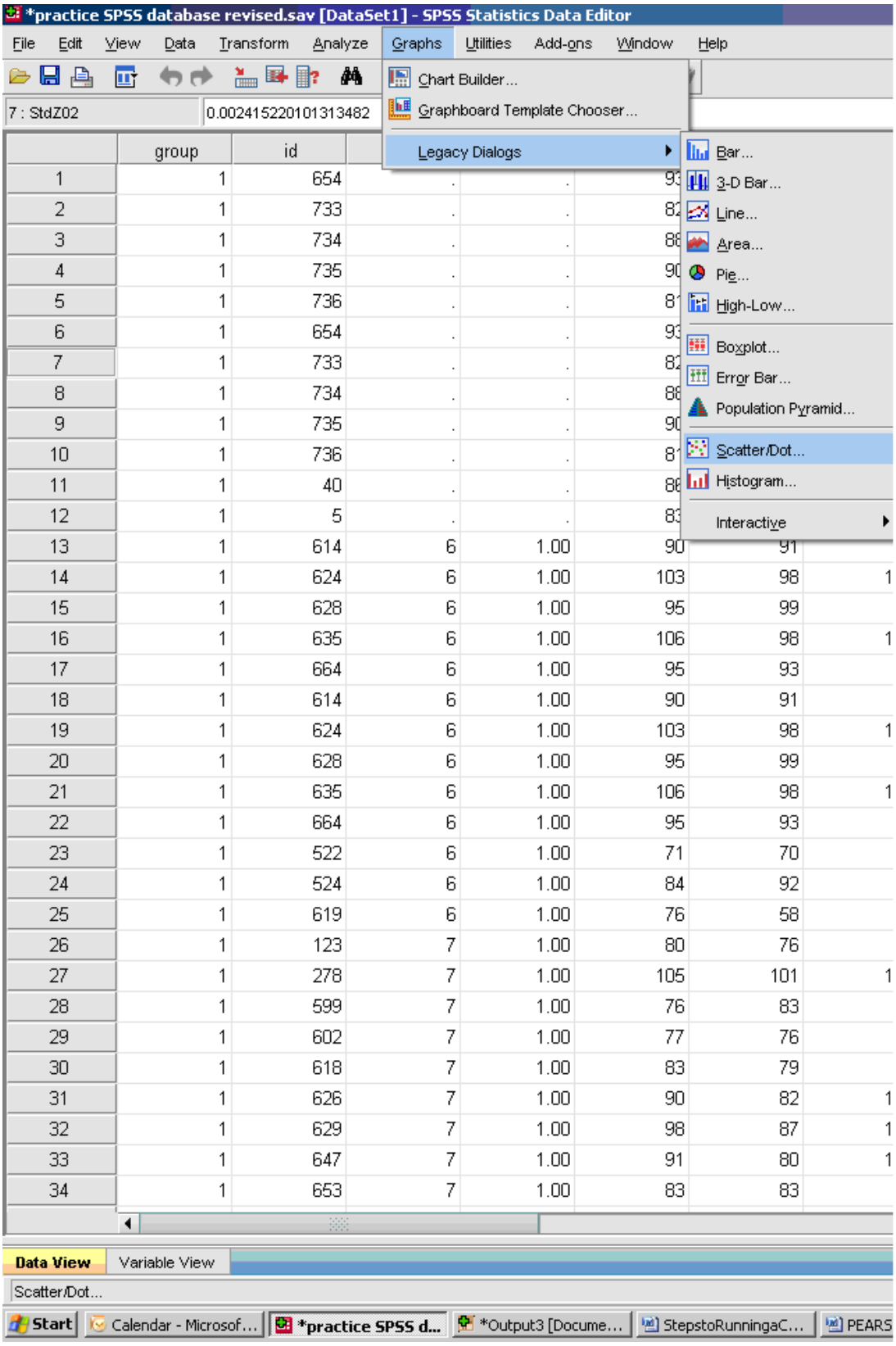
Research questions for which correlations are appropriate involve asking for relationships between or among variables. The research question, "What is the relationship between study skills and grades for high school students?" could be answered through use of a correlation.

4.2.1 Step One:

Perform ScatterPlots

[5] http://www.writingandstatisticalhelp.com
[6] http://www.ncpeapublications.org
[7] http://ncpeapublications.org/about-elr.html
[8] http://cnx.org/content/col10606/latest/
[9] http://davidmlane.com/hyperstat/
[10] http://www.statsoft.com/textbook/

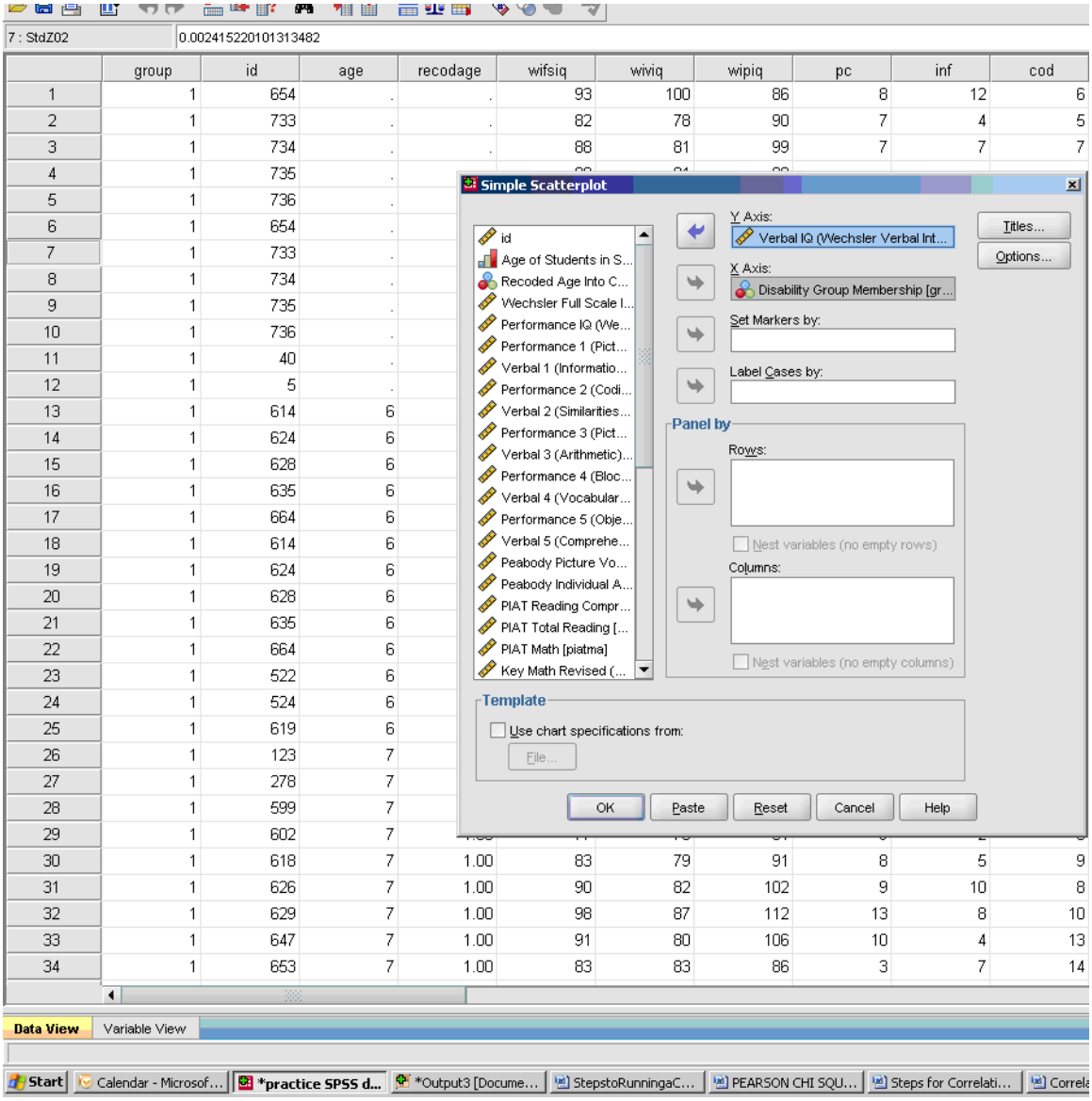
√ Graphs
√ Legacy Dialogs
√ Scatter/Dot
√ The Simple Scatter icon should be highlighted



	group	id					
1	1	654	.	.	93		
2	1	733	.	.	82		
3	1	734	.	.	88		
4	1	735	.	.	90		
5	1	736	.	.	81		
6	1	654	.	.	93		
7	1	733	.	.	82		
8	1	734	.	.	88		
9	1	735	.	.	90		
10	1	736	.	.	81		
11	1	40	.	.	88		
12	1	5	.	.	83		
13	1	614	6	1.00	90	91	
14	1	624	6	1.00	103	98	1
15	1	628	6	1.00	95	99	
16	1	635	6	1.00	106	98	1
17	1	664	6	1.00	95	93	
18	1	614	6	1.00	90	91	
19	1	624	6	1.00	103	98	1
20	1	628	6	1.00	95	99	
21	1	635	6	1.00	106	98	1
22	1	664	6	1.00	95	93	
23	1	522	6	1.00	71	70	
24	1	524	6	1.00	84	92	
25	1	619	6	1.00	76	58	
26	1	123	7	1.00	80	76	
27	1	278	7	1.00	105	101	1
28	1	599	7	1.00	76	83	
29	1	602	7	1.00	77	76	
30	1	618	7	1.00	83	79	
31	1	626	7	1.00	90	82	1
32	1	629	7	1.00	98	87	1
33	1	647	7	1.00	91	80	1
34	1	653	7	1.00	83	83	

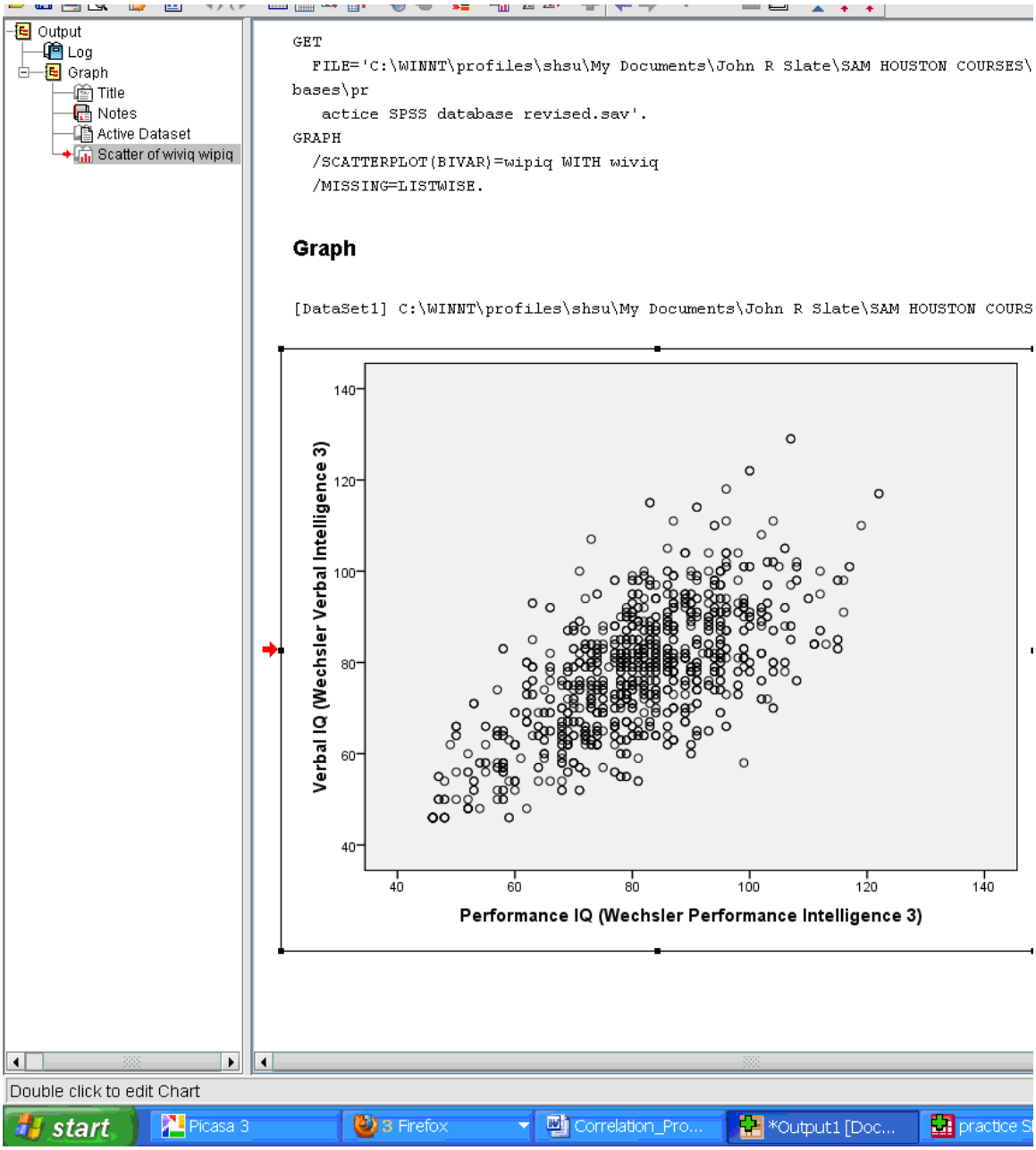
[11] http://cnx.org/content/m37278/latest/figure3.1.PNG/image

√ Define
√ Drag one of the two variables of interest to the first box (Y axis) on the right hand side and the other variable of interest to the second box (X axis) on the right hand side. It does not matter which variable goes in the X or Y axis because your scatterplot results will be the same.
Once you have a variable in each of the two boxes, click on the OK tab on the bottom left hand corner of the screen.



√ Look at the scatterplots to see whether a linear relationship is present.
In the screenshot below, the relationship is very clearly linear.

[12] http://cnx.org/content/m37278/latest/figure3.2.PNG/image



[13]

4.2.2 Step Two:

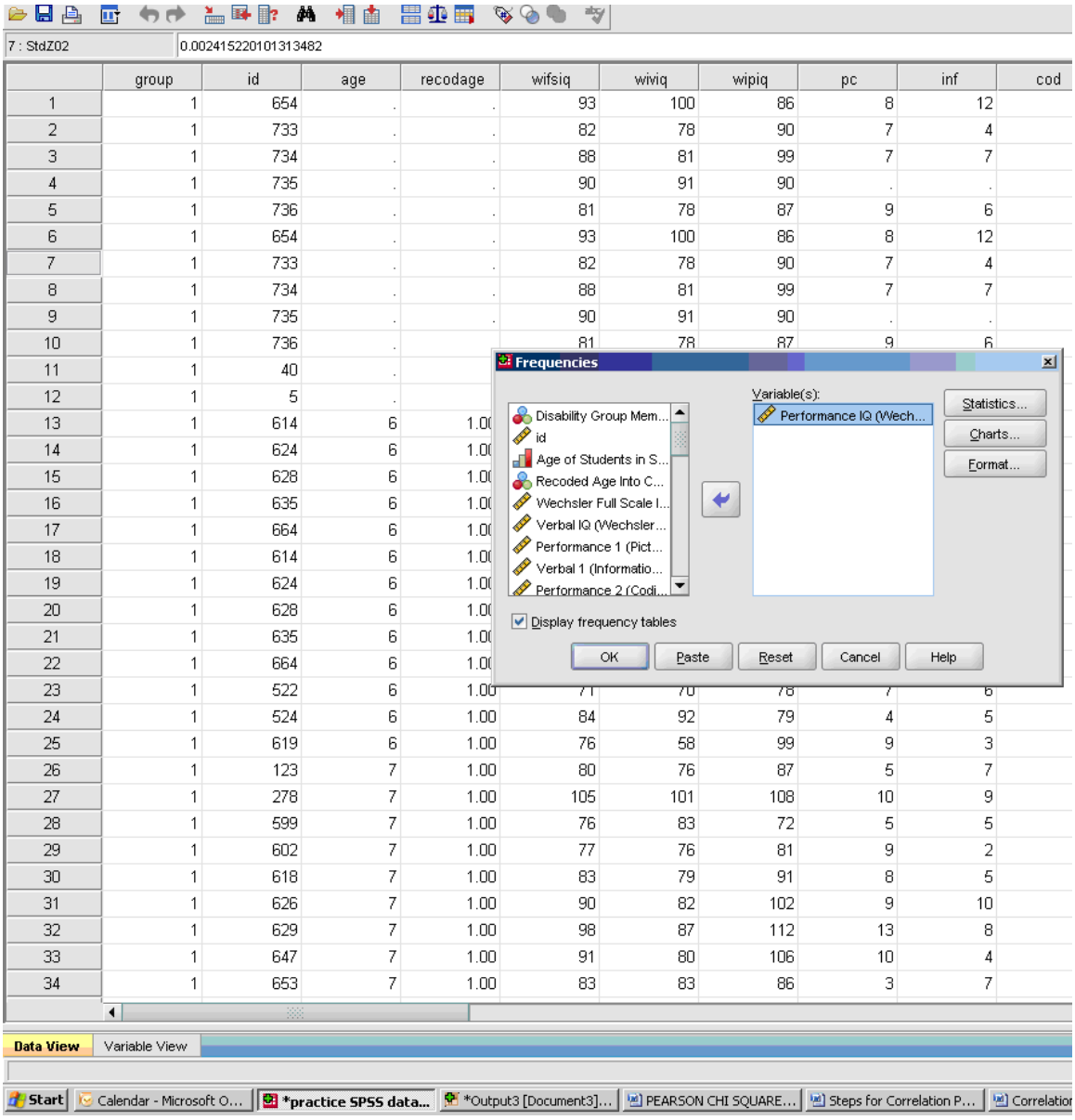
Calculate Descriptive Statistics on Variables

√ Analyze

* Descriptive Statistics
* Frequencies
* Click on the variables for which you want descriptive statistics (your dependent variables)
* You may click on each variable separately or highlight several of them

[13] http://cnx.org/content/m37278/latest/figure3.3.PNG/image

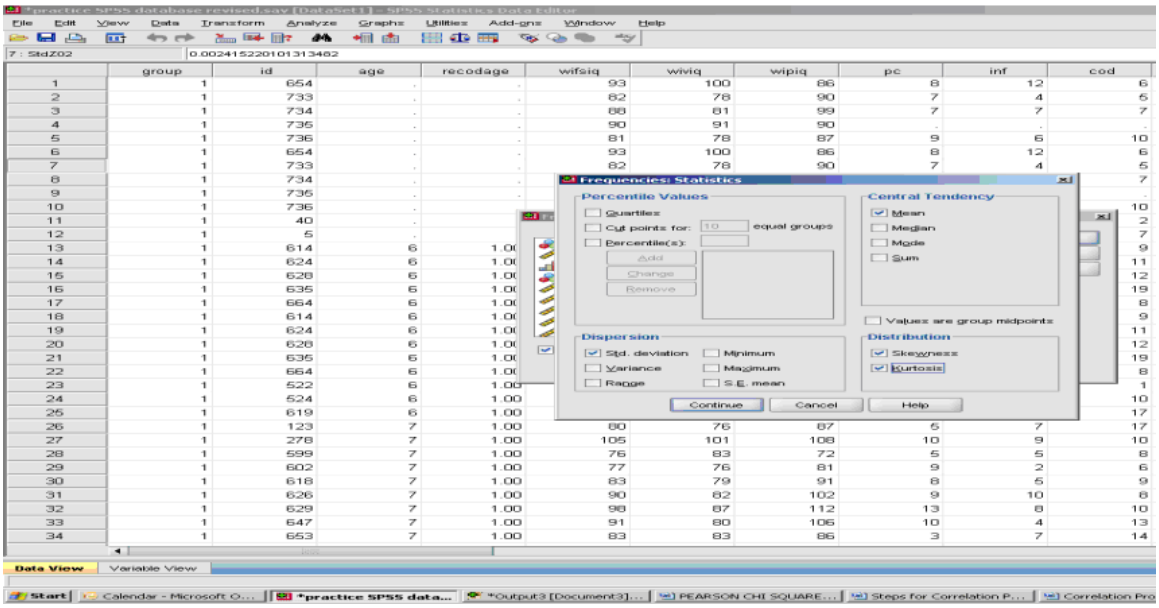
* * Once you have a variable in the left hand cell highlighted, click on the arrow in the middle to send the variable to the empty cell titled Variable(s)



	group	id	age	recodage	wifsiq	wiviq	wipiq	pc	inf	cod
1	1	654	.	.	93	100	86	8	12	
2	1	733	.	.	82	78	90	7	4	
3	1	734	.	.	88	81	99	7	7	
4	1	735	.	.	90	91	90	.	.	
5	1	736	.	.	81	78	87	9	6	
6	1	654	.	.	93	100	86	8	12	
7	1	733	.	.	82	78	90	7	4	
8	1	734	.	.	88	81	99	7	7	
9	1	735	.	.	90	91	90	.	.	
10	1	736	.	.	81	78	87	9	6	
11	1	40	.							
12	1	5	.							
13	1	614	6	1.00						
14	1	624	6	1.00						
15	1	628	6	1.00						
16	1	635	6	1.00						
17	1	664	6	1.00						
18	1	614	6	1.00						
19	1	624	6	1.00						
20	1	628	6	1.00						
21	1	635	6	1.00						
22	1	664	6	1.00						
23	1	522	6	1.00	71	70	78	7	6	
24	1	524	6	1.00	84	92	79	4	5	
25	1	619	6	1.00	76	58	99	9	3	
26	1	123	7	1.00	80	76	87	5	7	
27	1	278	7	1.00	105	101	108	10	9	
28	1	599	7	1.00	76	83	72	5	5	
29	1	602	7	1.00	77	76	81	9	2	
30	1	618	7	1.00	83	79	91	8	5	
31	1	626	7	1.00	90	82	102	9	10	
32	1	629	7	1.00	98	87	112	13	8	
33	1	647	7	1.00	91	80	106	10	4	
34	1	653	7	1.00	83	83	86	3	7	

√ Statistics
* Click on as many of the options you would like to see results
* At the minimum, click on: *M*, *SD*, Skewness, and Kurtosis

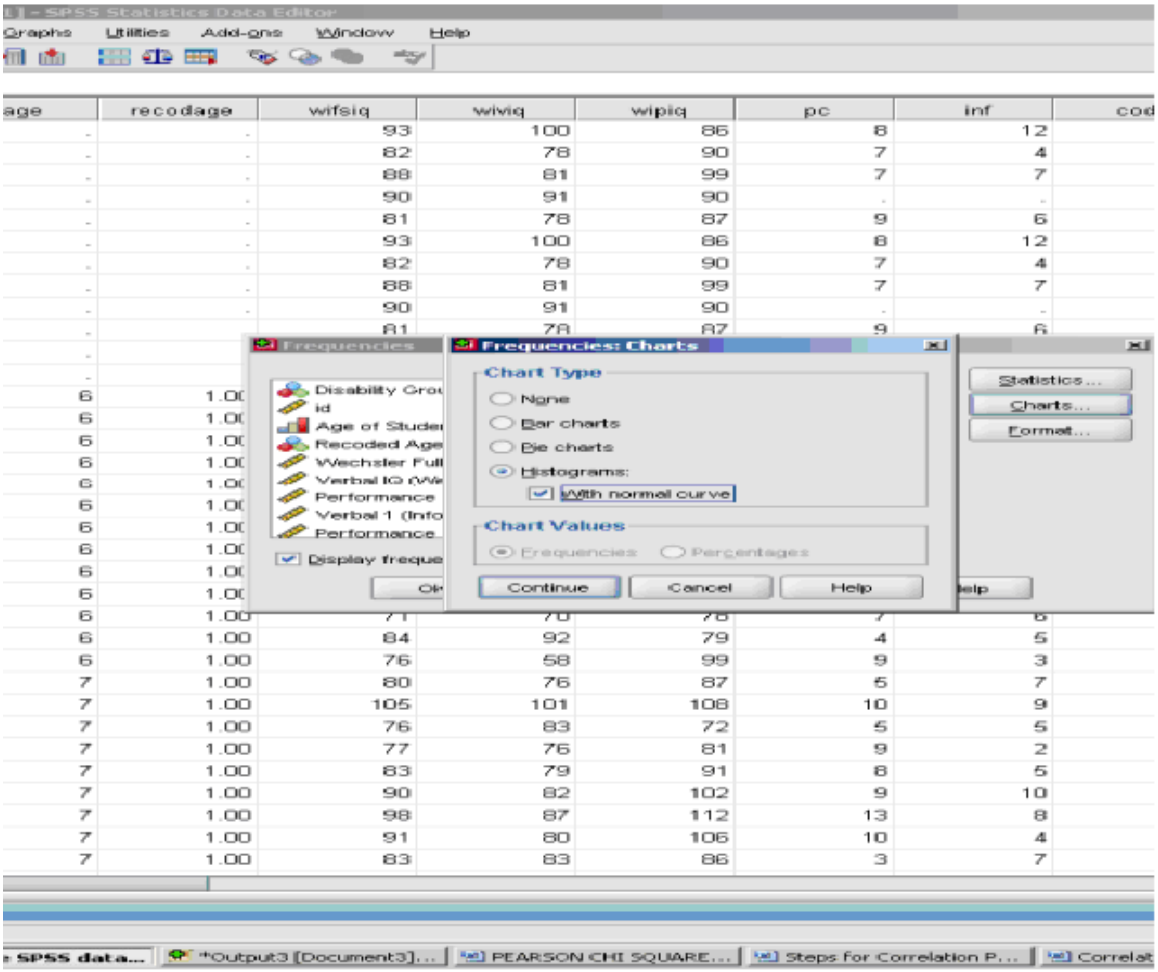
[14] http://cnx.org/content/m37278/latest/figure3.4.PNG/image



[15]

* Continue
* Charts (these are calculated only if you wish to have visual depictions of skewness and of kurtosis-they are not required)
* Histograms (not required, optional) with Normal Curve

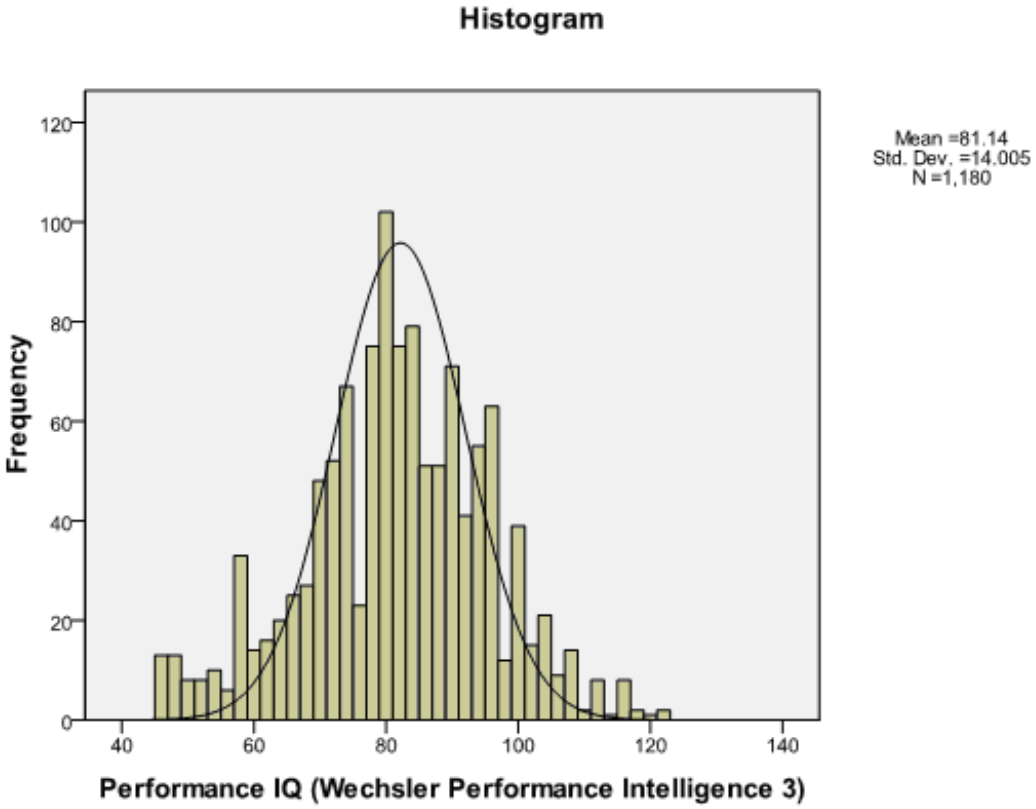
[15] http://cnx.org/content/m37278/latest/figure3.5.PNG/image



[16]

* Continue
* OK

[16] http://cnx.org/content/m37278/latest/figure3.6.PNG/image



[17]

4.2.3 Step Three:

Check for Skewness and Kurtosis values falling within/without the parameters of normality (-3 to +3)

* Skewness [Note. Skewness refers to the extent to which the data are normally distributed around the mean. Skewed data involve having either mostly high scores with a few low ones or having mostly low scores with a few high ones.] Readers are referred to the following sources for a more detailed definition of skewness: http://www.statistics.com/index.php?page=glossary&term_id=356[18] and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[19]

To standardize the skewness value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the skewness value from the SPSS output (in this case it is -.177) and divide it by the Std. error of skewness (in this case it is .071). If the resulting calculation is within -3 to +3, then the skewness of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside of this +/-3 range, the dataset is not normally distributed.

* Kurtosis [Note. Kurtosis also refers to the extent to which the data are normally distributed around the mean. This time, the data are piled up higher than normal around the mean or piled up higher than normal at the ends of the distribution.] Readers are referred to the following sources for a more detailed definition of kurtosis: http://www.statistics.com/index.php?page=glossary&term_id=326[20] and

[17] http://cnx.org/content/m37278/latest/figure3.7.1.PNG/image
[18] http://www.statistics.com/index.php?page=glossary&term_id=356
[19] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[20] http://www.statistics.com/index.php?page=glossary&term_id=326

http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[21]

To standardize the kurtosis value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the kurtosis value from the SPSS output (in this case it is .072) and divide it by the Std. error of kurtosis (in this case it is .142). If the resulting calculation is within -3 to +3, then the kurtosis of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside of this +/-3 range, the dataset is not normally distributed.

Performance IQ (Wechsler Performance Intelligence 3)

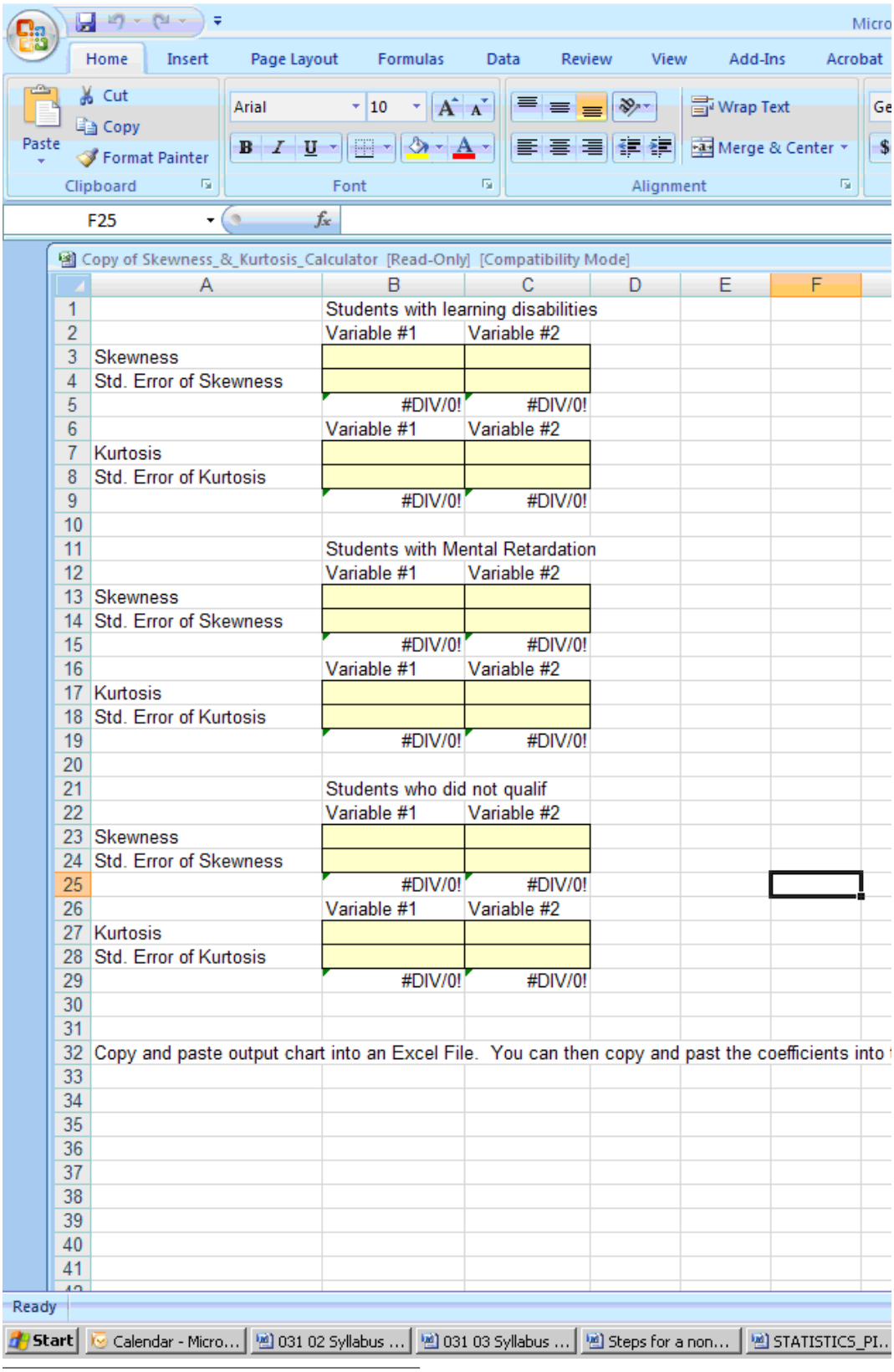
Statistics		
Performance IQ (Wechsler Performance Intelligence 3)		
N	Valid	1180
	Missing	2
Mean		81.14
Std. Deviation		14.005
Skewness		-.177
Std. Error of Skewness		.071
Kurtosis		.072
Std. Error of Kurtosis		.142

Table 4.1

Standardized Coefficients Calculator

Copy variable #1 and #2 into the skewness and kurtosis calculator

[21] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb

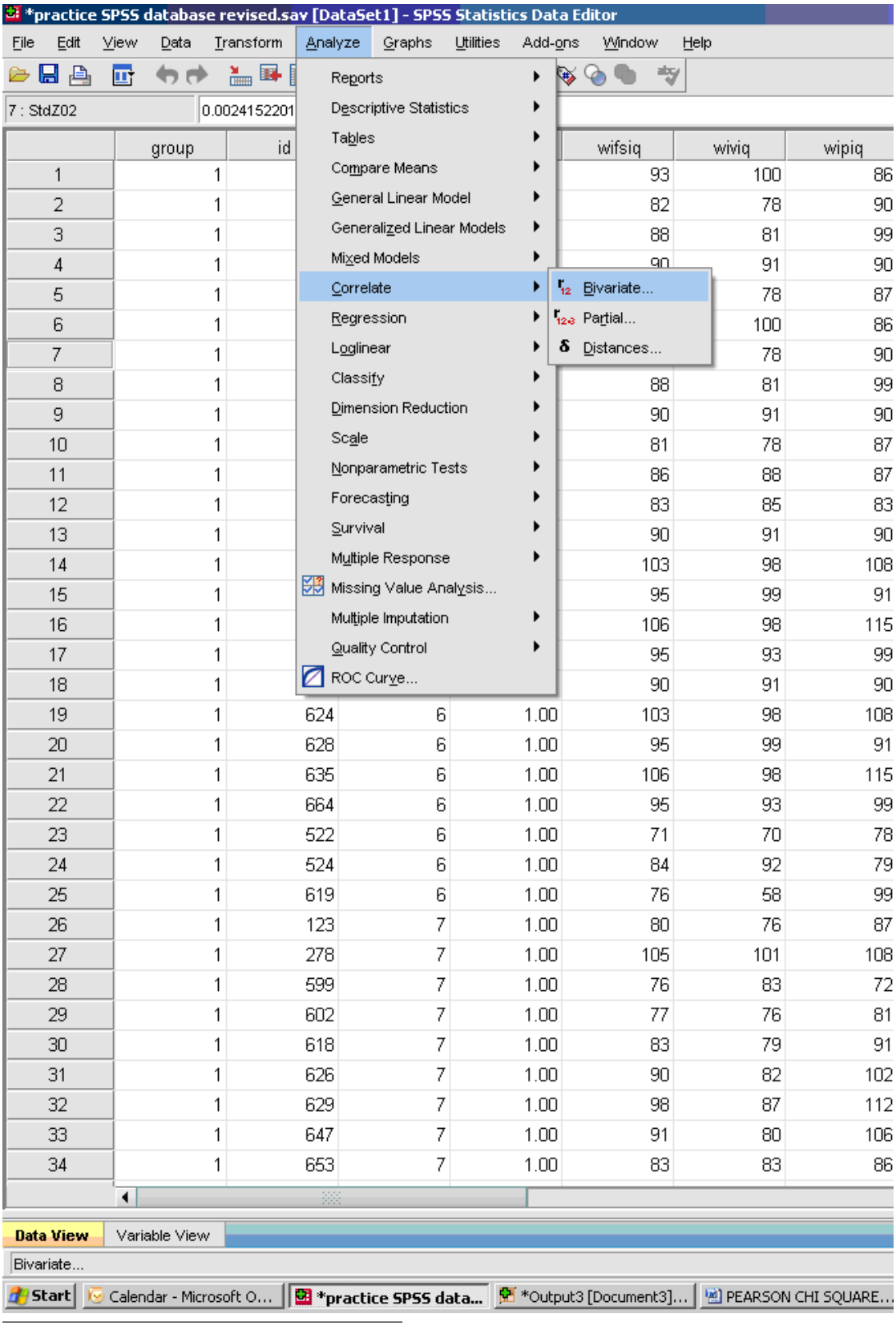


[22]

[22] http://cnx.org/content/m37278/latest/figure3.8.PNG/image

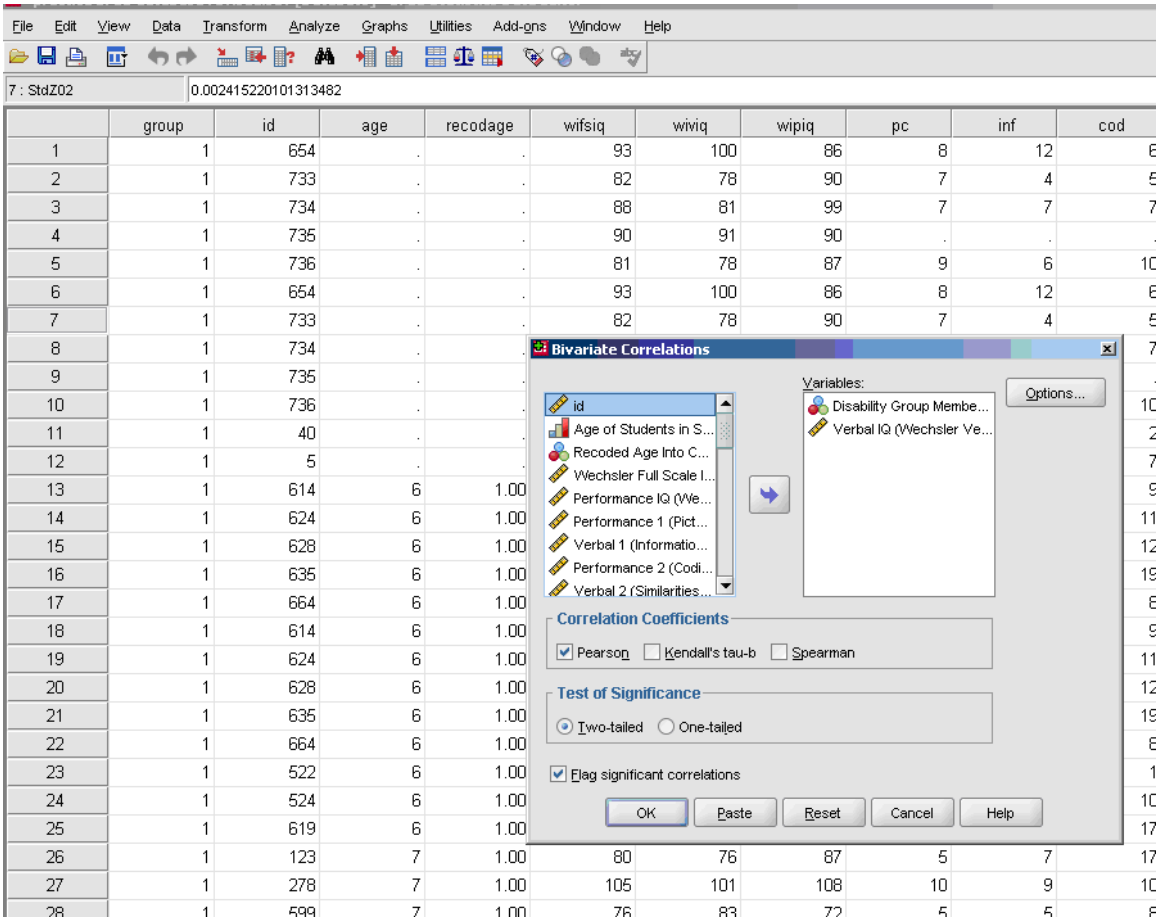
4.2.4 Step Four:

Calculate a Correlation Procedure on the Data
√ Analyze
√ Correlate
√ Bivariate



[23]http://cnx.org/content/m37278/latest/figure3.9.PNG/image

√ Send Over Variables on which you want to calculate a correlation by clicking on the variables in the left hand cell and then clicking on the middle arrow to send them to the right hand cell.
√ Perform a Pearson *r* if the standardized skewness coefficients and standardized kurtosis coefficients are within normal limits—the Pearson *r* is the default
√ Calculate a Spearman rho if the standardized skewness coefficients and standardized kurtosis coefficients are outside of the normal limits of +/- 3
√ To calculate a Spearman rho, click on the Spearman button and unclick the Pearson *r*
√ Use the default two-tailed test of significance
√ Use the Flag significant Correlation



[24]

√ OK

4.2.5 Step Five:

Check for Statistical Significance

1. Go to the correlation box
2. Follow Sig. (2-tailed) row over to chosen variable column
3. If you have any value less than .05 or less than your Bonferroni adjustment, if you are calculating multiple correlations on the same sample in the same study, then you have statistical significance.

[24] http://cnx.org/content/m37278/latest/figure3.10.PNG/image

Correlations

		Verbal IQ (Wechsler Verbal Intelligence 3)	Performance IQ (Wechsler Performance Intelligence 3)
Verbal IQ (Wechsler Verbal Intelligence 3)	Pearson Correlation	1	.664**
	Sig. (2-tailed)		.000
	N	1182	1180
Performance IQ (Wechsler Performance Intelligence 3)	Pearson Correlation	.664**	1
	Sig. (2-tailed)	.000	
	N	1180	1180
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 4.2

NOTE: [In this matrix, it appears that four unique correlations are present, one per cell. In fact, only one unique correlation, or *r*, is present in this four cell matrix.]

4.2.6 Step Six:

Check For Effect Size

1. Go to the correlation box
2. Find Pearson's Correlation Row or Spearman rho's and follow it to the variable column.
3. Your effect size will be located in the cell where the above intersect.
4. The effect size is calculated as:

4.2.6.1 Cohen's criteria for correlations (1998)

.1 = small (range from .1 to .29)
.3 = moderate (range from .3 to .49)
.5 = large (range from .5 to 1.0)

NOTE: Correlations cannot be greater than 1.00, therefore a 0 should not be placed in front of the decimal.

4.2.7 Step Seven:

Check the Level of Variance the Variables Have in Common

1. Square the Pearson Correlation Value or Spearman rho value to find the variance
2. In this example, the Verbal IQ and the Performance IQ share 44.09% of the variance in common (see correlation value of .664).

Correlations

		Verbal IQ (Wechsler Verbal Intelligence 3)	Performance IQ (Wechsler Performance Intelligence 3)
Verbal IQ (Wechsler Verbal Intelligence 3)	Pearson Correlation	1	.664**
	Sig. (2-tailed)		.000
	N	1182	1180
Performance IQ (Wechsler Performance Intelligence 3)	Pearson Correlation	.664**	1
	Sig. (2-tailed)	.000	
	N	1180	1180
** Correlation is significant at the 0.01 level (2-tailed).			

Table 4.3

4.2.8 Step Eight:

Write the Numerical Sentence

1. $r(n)_{sp}=_{sp}$correlation coefficient,$_{sp}p_{sp}<_{sp}.001$ (or Bonferroni-adjusted alpha significance error rate).
2. Using this example: $r(1180) = .66$, $p < .001$

NOTE: [sp means to insert a space.] Remember that all mathematical symbols are placed in italics.

4.2.9 Step Nine:

Narrative and Interpretation

1. r value
2. sample size or n
3. p value
4. r^2 value
5. $r(1180) = .66$, $p < .001$, 44.09% of variance accounted for.
6. Note that the r value itself is the effect size.

4.3 Writing Up Your Statistics

So, how do you "write up" your Research Questions and your Results? Schuler W. Huck (2000) in his seminal book entitled, *Reading Statistics and Research,* points to the importance of your audience understanding and making sense of your research in written form. Huck further states:

4.3.1

This book is designed to help people *decipher* what researchers are trying to communicate in the written or oral summaries of their investigations. Here, the goal is simply to distill meaning from the words, symbols, tables, and figures included in the research report. To be competent in this arena, one must not only be able to decipher what's presented but also to "fill in the holes"; this is the case because researchers typically assume that those receiving the research report are familiar with unmentioned details of the research process and statistical treatment of data.

Writing Up Your Correlations
Researchers and Professors John Slate and Ana Rojas-LeBouef understand this critical issue, so often neglected or not addressed by other authors and researchers. They point to the importance of doctoral students "writing up their statistics" in a way that others can understand your reporting and as importantly, interpret the meaning of your significant findings and implications for the preparation and practice of educational leadership. Slate and LeBouef provide you with a model for "writing up your Parametric and Non-Parametric Correlations statistics."

Click here to view: *Writing Up Your Parametric Correlation Statistics* [25]
Click here to view: *Writing Up Your Nonparamteric Correlation Statistics* [26]

4.4 References

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erbaum

Hyperstats Online Statistics Textbook. (n.d.) Retrieved from http://davidmlane.com/hyperstat/[27]

Kurtosis. (n.d.). Definition. Retrieved from http://www.statistics.com/index.php?page=glossary&term_id=326[28]

Kurtosis. (n.d.). *Definition of normality*. Retrieved from http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[29]

Onwuegbuzie, A. J., & Daniel, L. G. (2002). Uses and misuses of the correlation coefficient. *Research in the Schools, 9*(1), 73-90.

Skewness. (n.d.) Retrieved from http://www.statistics.com/index.php?page=glossary&term_id=356[30]

Skewness. (n.d.). *Definition of normality*. Retrieved from http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[31]

StatSoft, Inc. (2011). *Electronic statistics textbook*. Tulsa, OK: StatSoft. WEB: http://www.statsoft.com/textbook/[32]

[25] http://cnx.org/content/col11299/latest/
[26] http://cnx.org/content/col11299/latest/
[27] http://davidmlane.com/hyperstat/
[28] http://www.statistics.com/index.php?page=glossary&term_id=326
[29] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[30] http://www.statistics.com/index.php?page=glossary&term_id=356
[31] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[32] http://www.statsoft.com/textbook/

Chapter 5

Conducting a Parametric Independent Samples t-test[1]

NOTE: This chapter has been peer-reviewed, accepted, and endorsed by the National Council of Professors of Educational Administration (NCPEA) as a significant contribution to the scholarship and practice of education administration. Formatted and edited in Connexions by Theodore Creighton and Brad Bizzell, Virginia Tech, Janet Tareilo, Stephen F. Austin State University, and Thomas Kersten, Roosevelt University.

5.1

This chapter is part of a larger Collection (Book) and is available at: *Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts* [2]

NOTE: Slate and LeBouef have written a "companion book" which is available at: *Preparing and Presenting Your Statistical Findings: Model Write Ups* [3]

Authors Information

John R. Slate is a Professor at Sam Houston State University where he teaches Basic and Advanced Statistics courses, as well as professional writing, to doctoral students in Educational Leadership and Counseling. His research interests lie in the use of educational databases, both state and national, to reform school practices. To date, he has chaired and/or served over 100 doctoral student dissertation committees. Recently, Dr. Slate created a website Writing and Statistical Help[4] to assist students and faculty with both statistical assistance and in editing/writing their dissertations/theses and manuscripts.

[1] This content is available online at <http://cnx.org/content/m37279/1.5/>.
[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[3] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[4] http://www.writingandstatisticalhelp.com

Ana Rojas-LeBouef is a Literacy Specialist at the Reading Center at Sam Houston State University where she teaches developmental reading courses. She recently completed her doctoral degree in Reading, where she conducted a 16-year analysis of Texas statewide data regarding the achievement gap. Her research interests lie in examining the inequities in achievement among ethnic groups. Dr. Rojas-LeBouef also assists students and faculty in their writing and statistical needs on the website Writing and Statistical Help.[5]

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Thomas Kersten is a Professor at Roosevelt University in Chicago. Dr. Kersten is widely published and an experienced editor and is the author of Taking the Mystery Out of Illinois School Finance[8] , a Connexions Print on Demand publication. He is also serving as Editor in Residence for this book by Slate and LeBouef.

5.2 Conducting a Parametric Independent Samples t-test

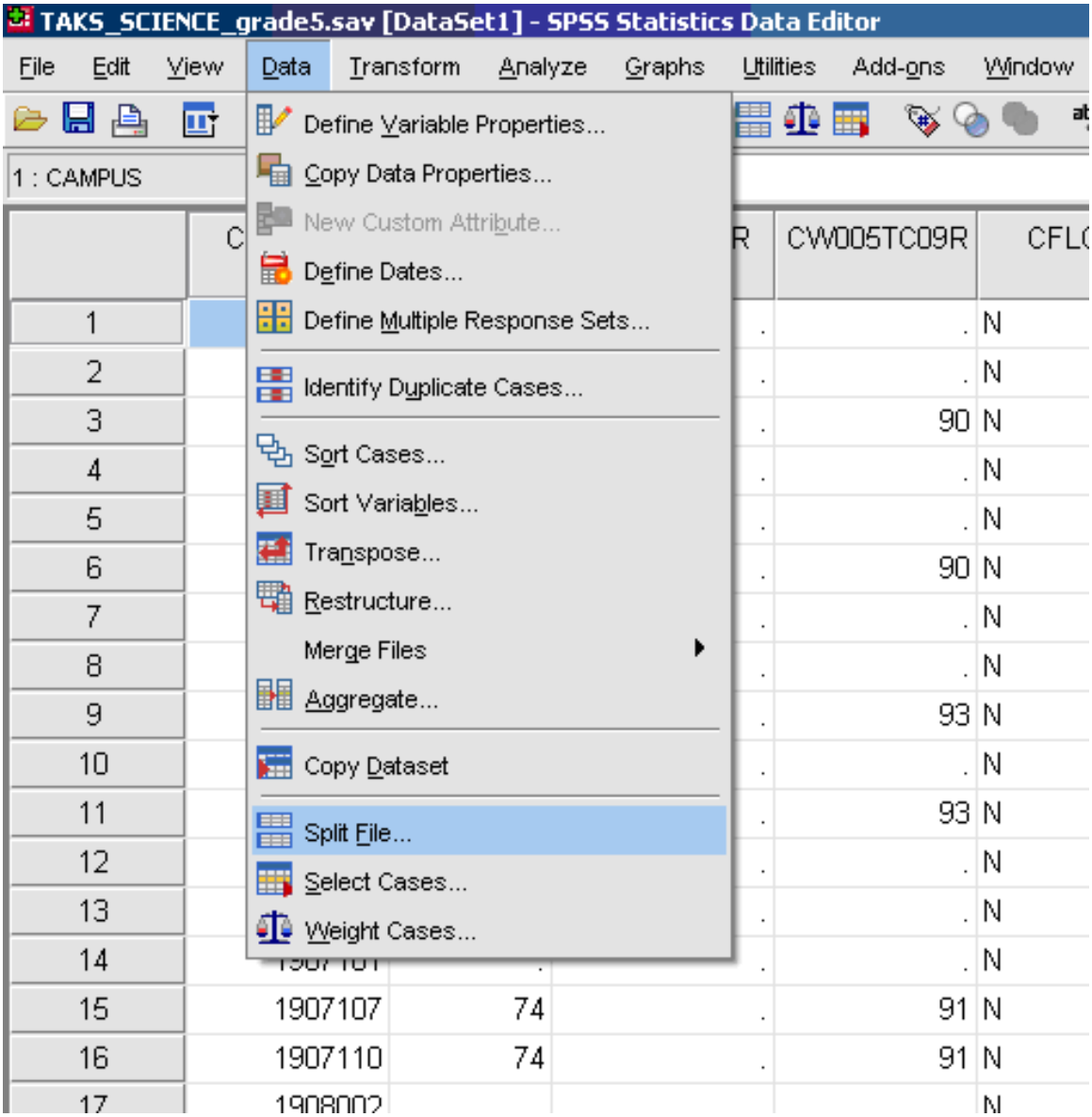
In this set of steps, readers will calculate either a parametric or a nonparametric statistical analysis, depending on whether the data for the dependent variable reflect a normal distribution. A parametric statistical procedure requires that its data be reflective of a normal curve whereas no such assumption is made in the use of a nonparametric procedure. Of the two types of statistical analyses, the parametric procedure is the more powerful one in ascertaining whether or not a statistically significant difference, in this case, exists. As such, parametric procedures are preferred over nonparametric procedures. When data are not normally distributed, however, parametric analyses may provide misleading and inaccurate results. According, nonparametric analyses should be used in cases where data are not reflective of a normal curve. In this set of steps, readers are provided with information on how to make the determination of normally or nonnormally distributed data. For detailed information regarding the assumptions underlying parametric and nonparametric procedures, readers are referred to the Hyperstats Online Statistics Textbook at http://davidmlane.com/hyperstat/[9] or to the *Electronic Statistics Textbook* (2011) at http://www.statsoft.com/textbook/[10]

For this parametric independent samples *t*-test to be appropriately used, at least half of the standardized skewness coefficients and the standardized kurtosis coefficients must be within the normal range (+/-3, Onwuegbuzie & Daniel, 2002). Research questions for which independent samples *t*-tests are appropriate involve asking for differences in a dependent variable by group membership (i.e., only two groups are present for *t*-tests). The research question, "What is the difference between boys and girls in their science performance among middle school students?" could be answered through use of an independent samples *t*-test.

[5] http://www.writingandstatisticalhelp.com
[6] http://www.ncpeapublications.org
[7] http://ncpeapublications.org/about-elr.html
[8] http://cnx.org/content/col10606/latest/
[9] http://davidmlane.com/hyperstat/
[10] http://www.statsoft.com/textbook/

5.2.1 Step One

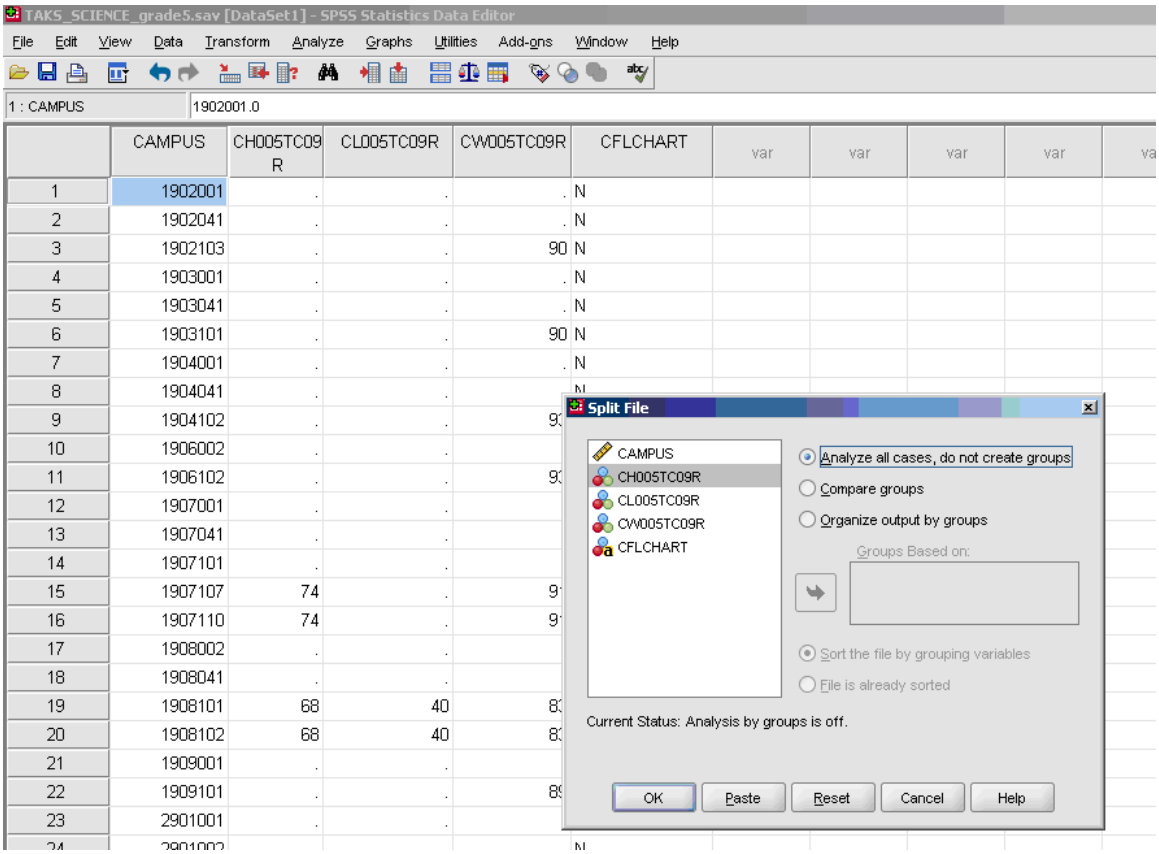
Calculate Frequencies on the Split Groups
√ Data
* Split File



[11]

Your screen will show that all cases are going to be analyzed and a "do not create groups". You will need to click the compare groups and move the independent variable over to the "Group Based on". In the case of a *t*-test, the grouping variable or independent variable will consist of two groups.

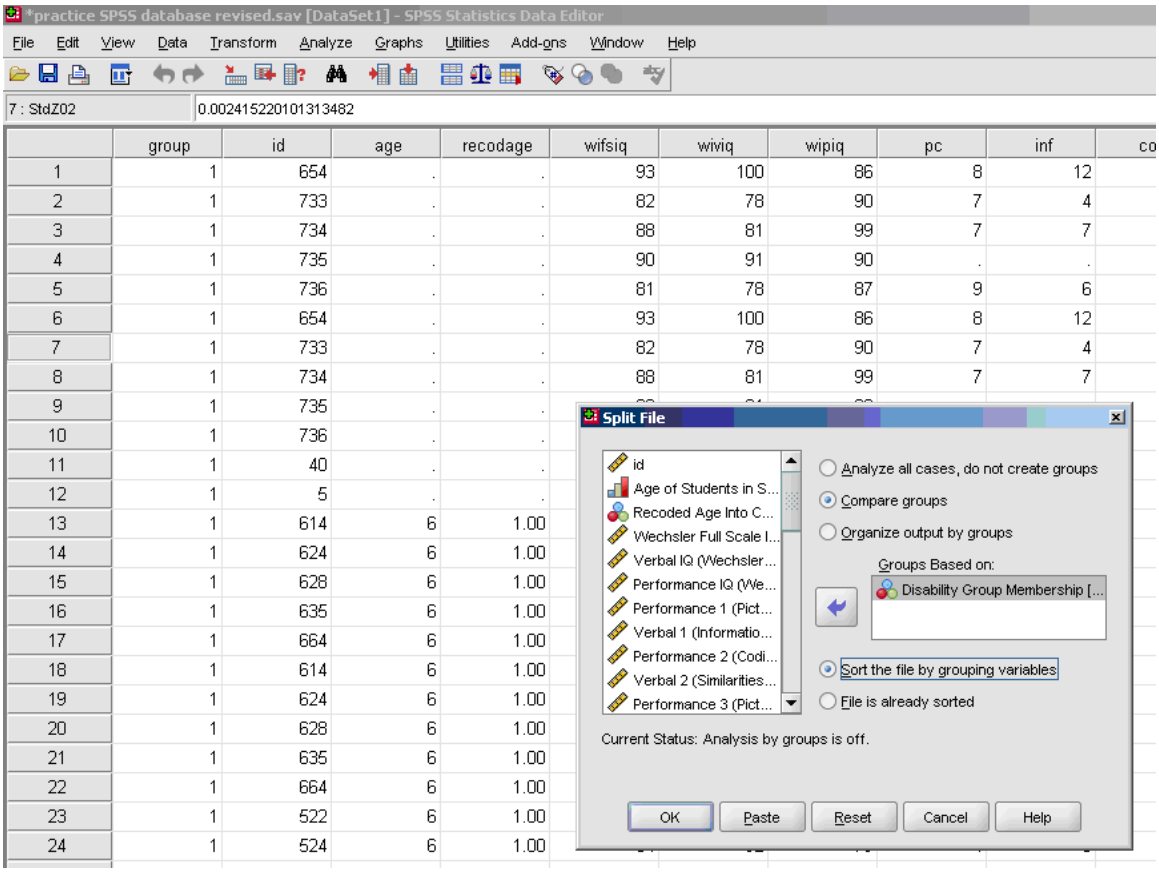
[11] http://cnx.org/content/m37279/latest/figure4.1.PNG/image



[12]

After you do this, your screen should resemble the following:

[12] http://cnx.org/content/m37279/latest/figure4.2.PNG/image

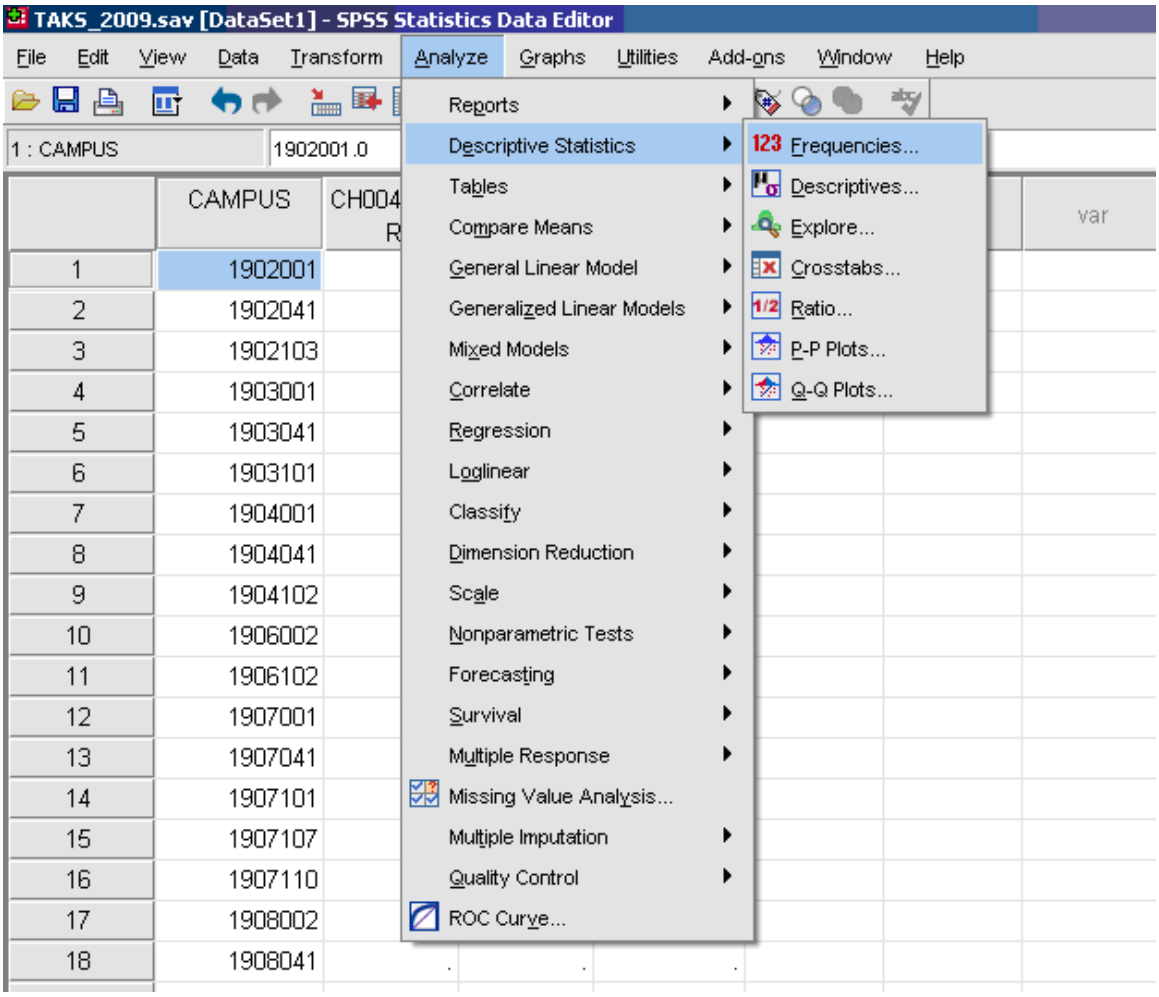


[13]

* Then click OK

√ Analyze
* Descriptive Statistics
* Frequencies

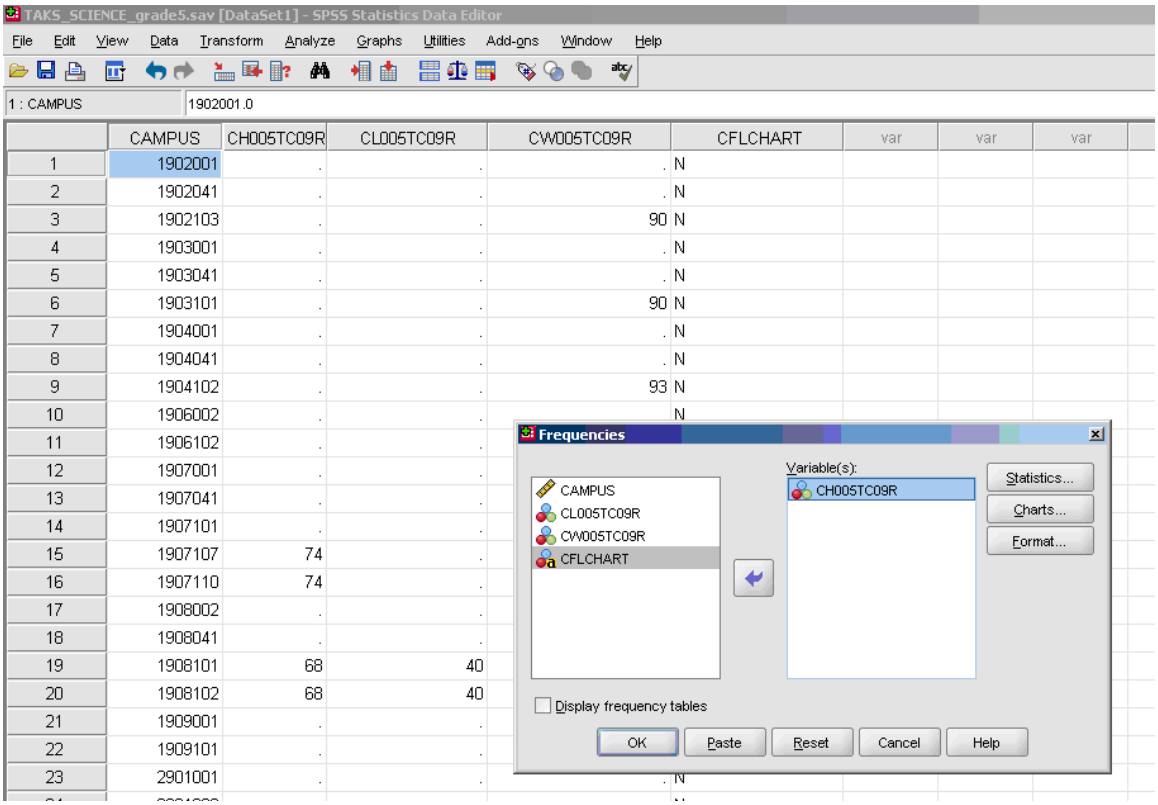
[13] http://cnx.org/content/m37279/latest/figure4.3.PNG/image



[14]

√ Move over the dependent (outcome) variable

[14] http://cnx.org/content/m37279/latest/figure4.4.PNG/image



[15]

√ Statistics
* Mean
* Standard Deviation
* Skewness [Note. Skewness refers to the extent to which the data are normally distributed around the mean. Skewed data involve having either mostly high scores with a few low ones or having mostly low scores with a few high ones.] Readers are referred to the following sources for a more detailed definition of skewness: http://www.statistics.com/index.php?page=glossary&term_id=356[16] and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[17]

To standardize the skewness value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the skewness value from the SPSS output and divide it by the Std. error of skewness. If the resulting calculation is within -3 to +3, then the skewness of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside of this +/-3 range, the dataset is not normally distributed.

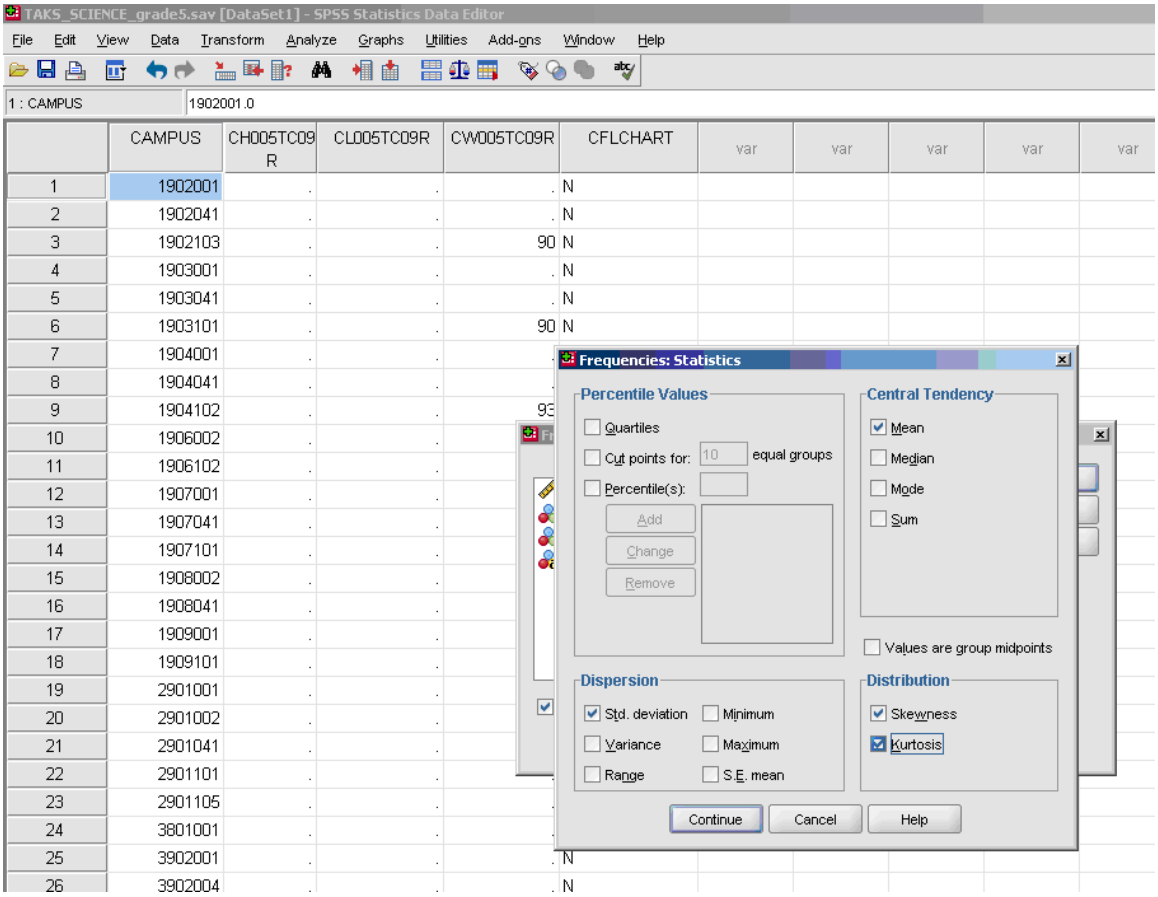
* Kurtosis [Note. Kurtosis also refers to the extent to which the data are normally distributed around the mean. This time, the data are piled up higher than normal around the mean or piled up higher than normal at the ends of the distribution.] Readers are referred to the following sources for a more detailed definition of kurtosis: http://www.statistics.com/index.php?page=glossary&term_id=326[18] and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[19]

To standardize the kurtosis value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the kurtosis value from the SPSS output and divide it by the Std. error of kurtosis. If the resulting calculation is within -3 to +3, then the kurtosis of the dataset

[15] http://cnx.org/content/m37279/latest/figure4.5.PNG/image
[16] http://www.statistics.com/index.php?page=glossary&term_id=356
[17] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[18] http://www.statistics.com/index.php?page=glossary&term_id=326
[19] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb

is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside of this +/-3 range, the dataset is not normally distributed.

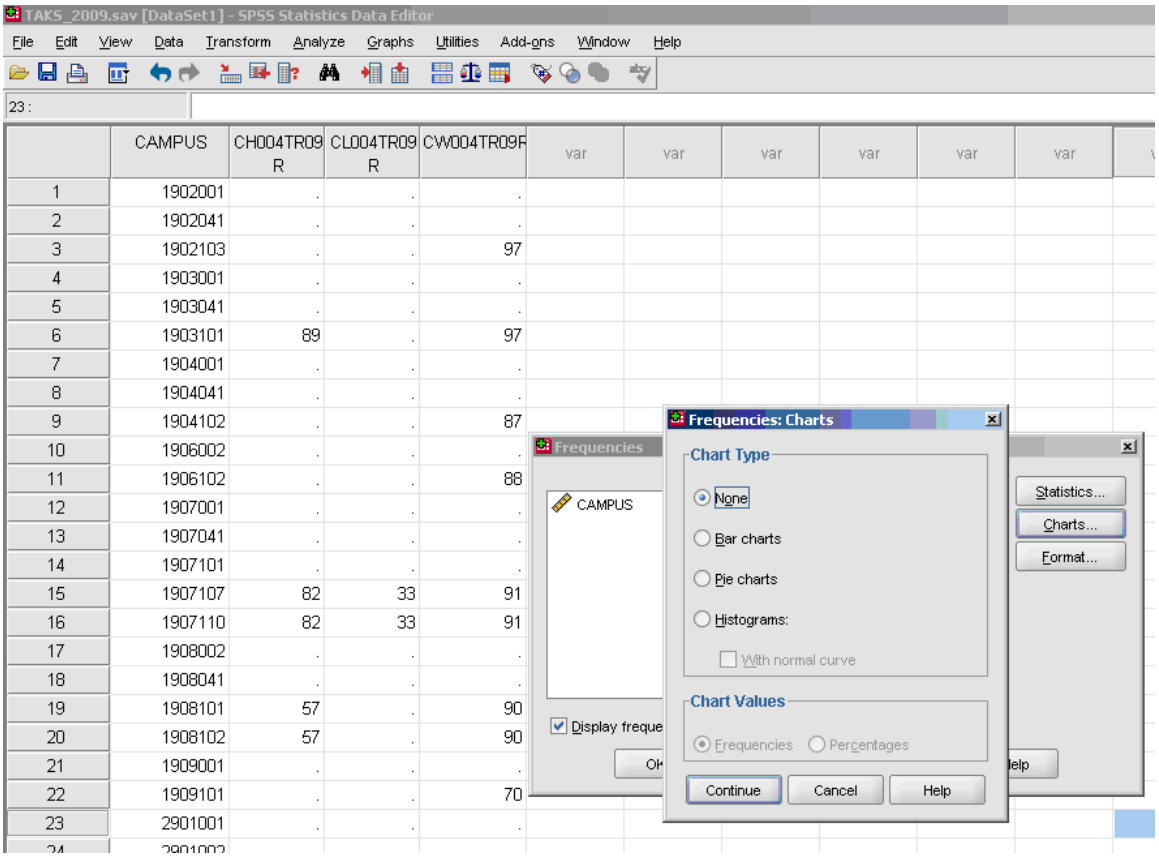
* Continue
* OK



[20]

√ Charts (these are calculated only if you wish to have visual depictions of skewness and of kurtosis-they are not required)
* Histogram~ with normal curve (not required, optional)
√ Continue
√ OK

[20] http://cnx.org/content/m37279/latest/figure4.6.PNG/image

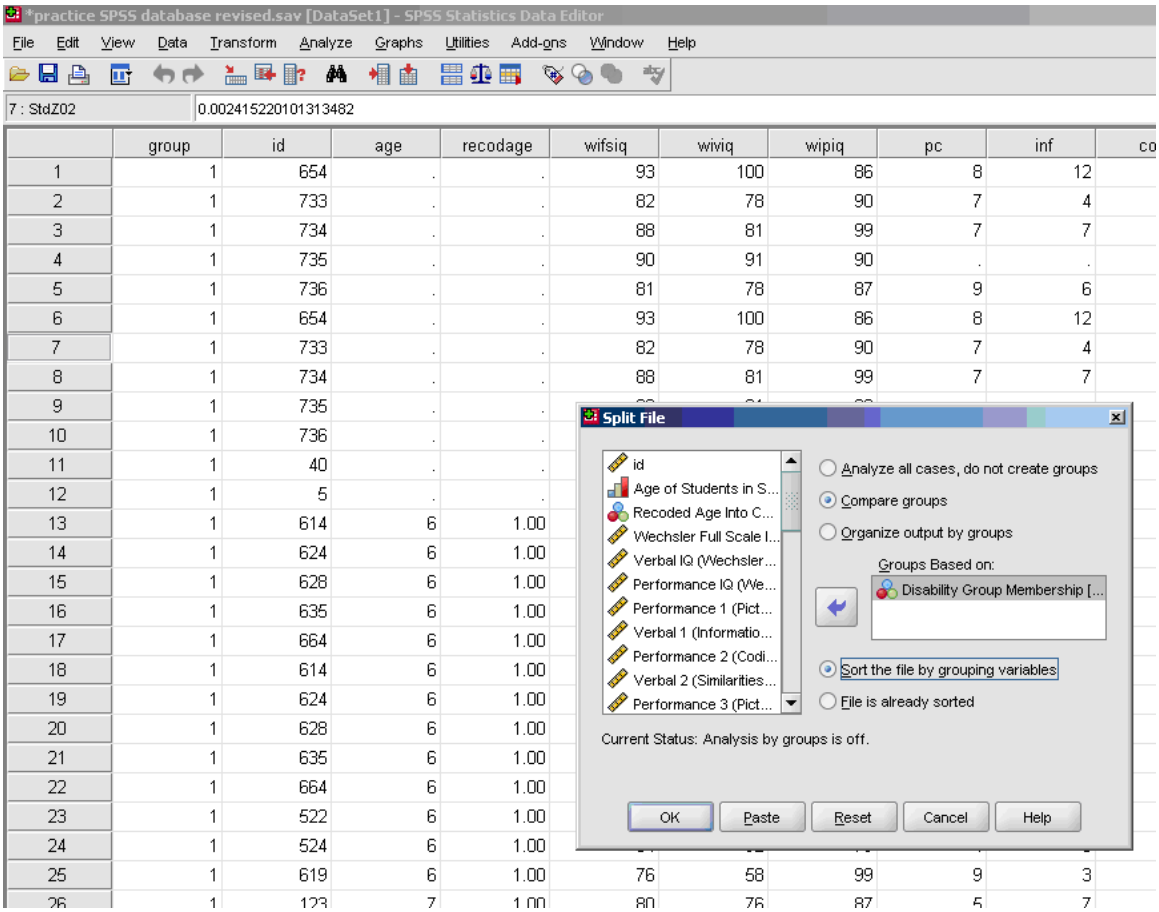


[21]

NOTE: Before you continue to another application you must complete the following:

√ Data
√ Split Files
√ Analyze all cases, do not create groups
√ OK

[21] http://cnx.org/content/m37279/latest/figure4.7.PNG/image



[22]

5.3

5.3.1 Step Two

Check for Skewness and Kurtosis values falling within/without the parameters of normality (-3 to +3). Note that each variable below has its own skewness and its own kurtosis values. Thus, a total of three standardized skewness coefficients and three standardized kurtosis coefficients can be calculated from information in the table below.

		CH005TC09R	CL005TC09R	CW005TC09R
N	Valid	3125	1805	1877
	Missing	5197	6517	6445

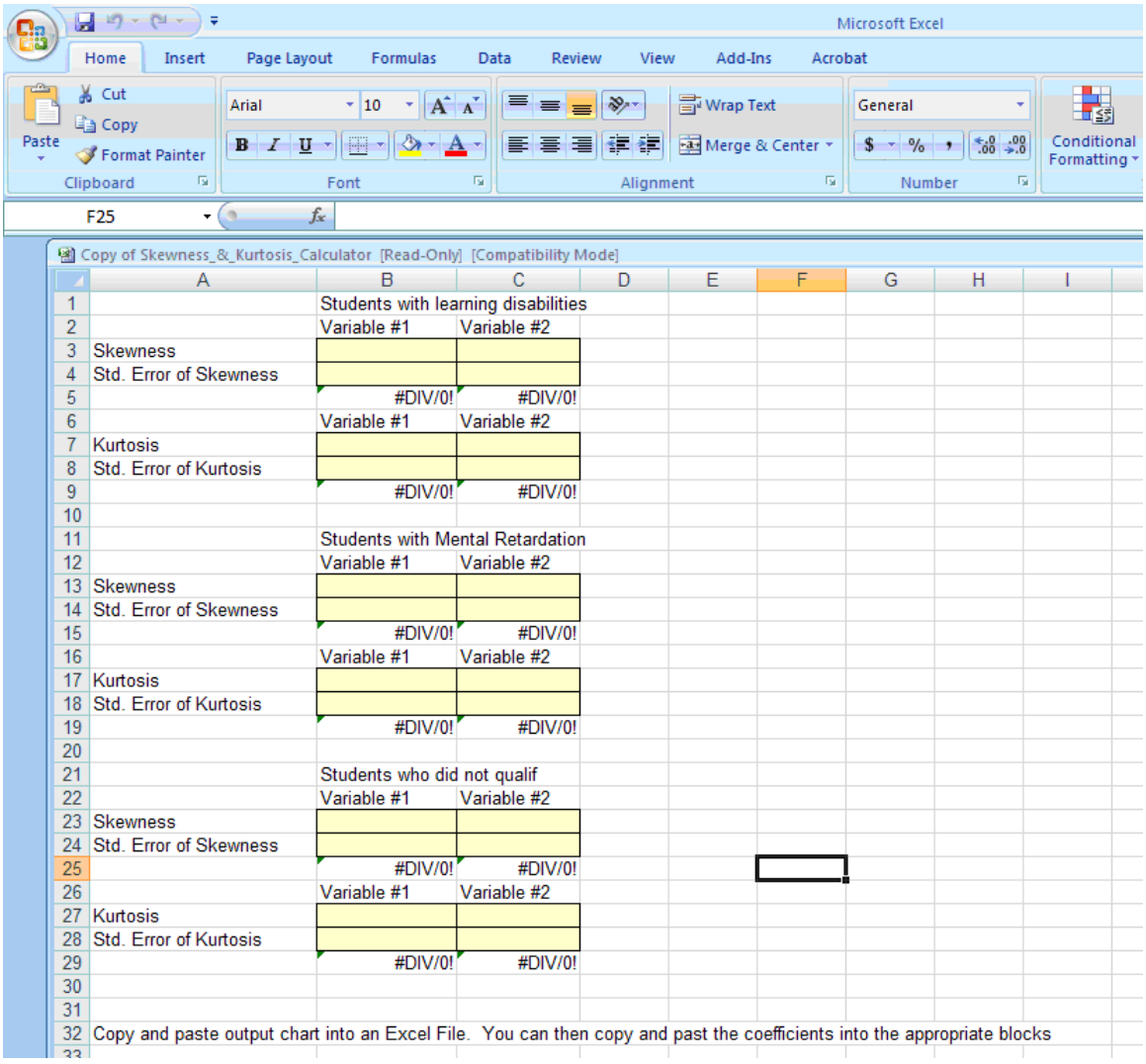
continued on next page

[22] http://cnx.org/content/m37279/latest/figure4.8.PNG/image

Skewness	-1.129	-.479	-2.197
Std. Error of Skewness	.044	.058	.056
Kurtosis	1.818	-.412	6.991
Std. Error of Kurtosis	.088	.115	.113

Table 5.1: Skewness and Kurtosis Coefficients

Standardized Coefficients Calculator
Copy variable #1 and #2 into the skewness and kurtosis calculator



[23]

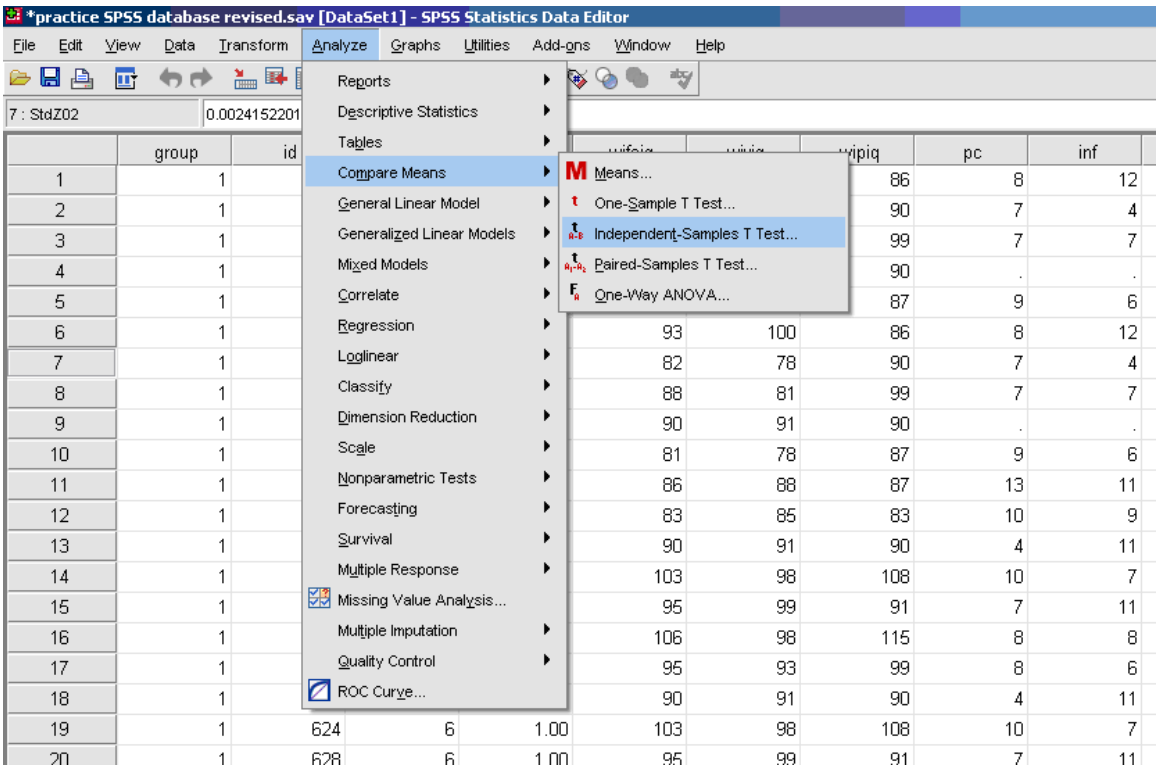
Note. Prior to calculating parametric independent t-tests, at least half of your standardized coefficients should be within the +/- 3 range.

5.4 Step Three

Calculate a Parametric Independent Samples t-test on Data (after you have unsplit your file)

[23] http://cnx.org/content/m37279/latest/figure4.9.PNG/image

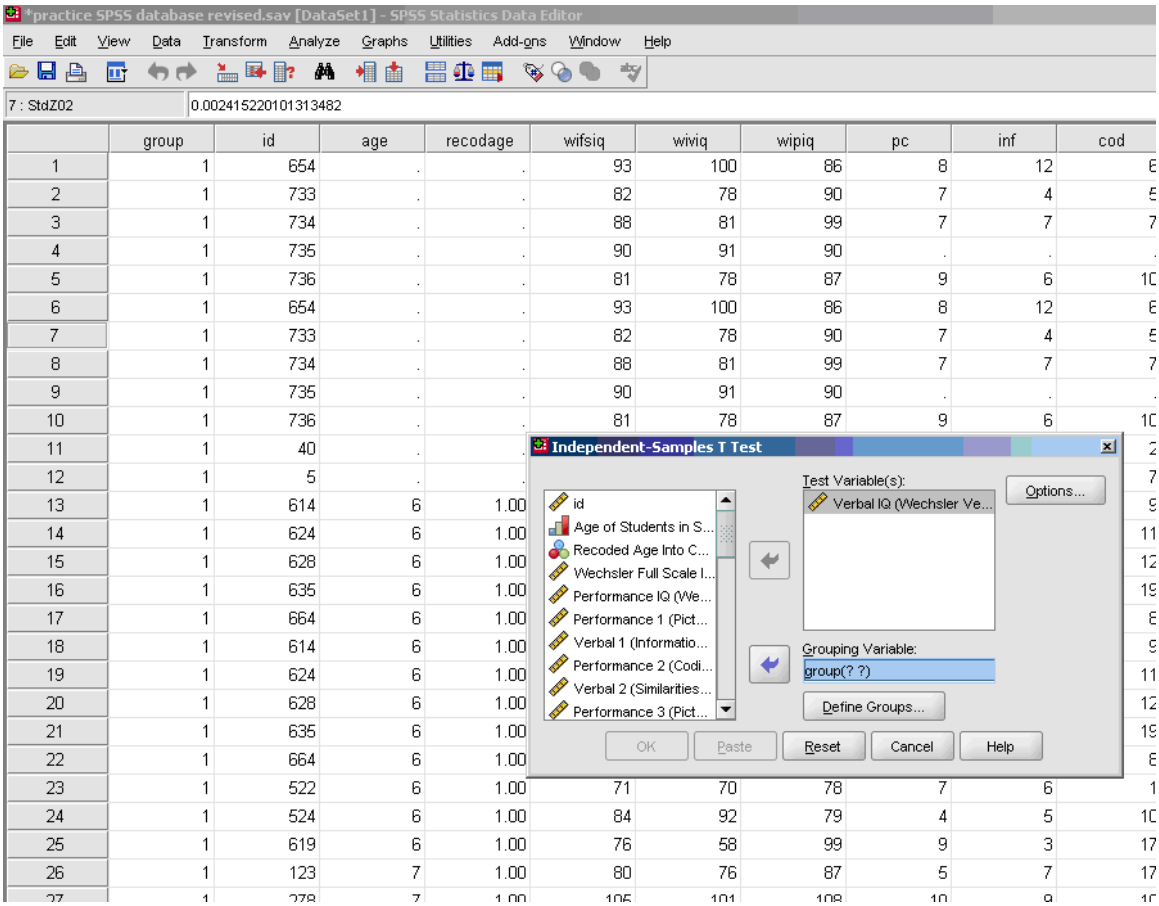
√ Analyze
√ Compare Means
√ Independent Samples *t*-test



[24]

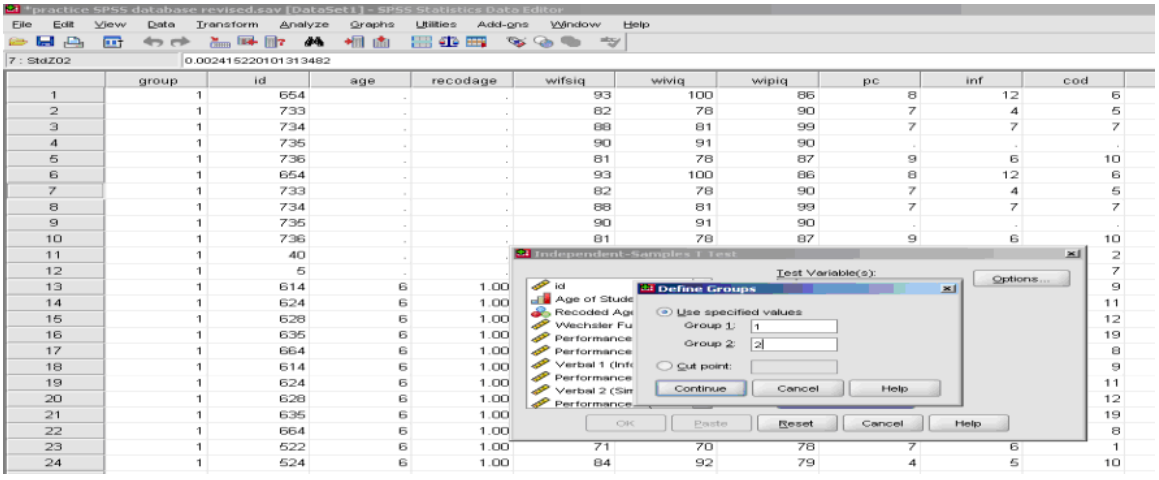
√ Test Variable would be your Dependent Variable (e.g., test scores)
√ Grouping Variable would be your dichotomous Independent Variable

[24] http://cnx.org/content/m37279/latest/figure4.10.PNG/image



[25]

√ Define Groups
√ Group One is No. 1 and Group Two is No. 2 (or whatever numbers you used to identify each group)
Note: Click on view than value labels to find the code for each group.
√ Continue



[26]

[25] http://cnx.org/content/m37279/latest/figure4.11.PNG/image
[26] http://cnx.org/content/m37279/latest/figure4.12.PNG/image

5.5 Step Four

Check for Statistical Significance

* Go to the Independent Samples Test Box (bottom row∼ Equal variances not assumed) and look at the cell labeled Sig. (2-tailed) to check for significance. Always use the bottom row.
* If you have any value less than .05 then you have statistical significance, unless you have adjusted for multiple statistical analyses using the Bonferroni procedure. Remember to replace the third zero with a 1, if the sig value is .000 (i.e., if the sig value reads as .000, replace the third 0, so it reads as .001). If you calculate more than one *t*-test, you must use the

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Verbal IQ (Wechsler Verbal Intelligence 3)	Equal variances assumed	15.880	.000	32.258	775	.000	22.946	.711	21.550	24.342
	Equal variances not assumed			34.672	686.950	.000	22.946	.662	21.647	24.245

Table 5.2: Independent Samples Test

1. Numerical Sentence = $t(df)_{\text{sp}}{=}_{\text{sp}} t,_{\text{sp}} p_{\text{sp}}{<}_{\text{sp}} .001$(or Bonferroni-adjusted alpha significance error rate).
- *df* is located in Independent Samples Box
- *t* is located in Independent Samples Box
2. Numerical sentence is written as: $t(686.95) = 34.67\ p < .001$, example was statistically significant.

5.6 Writing Up You Statistcs

So, how do you "write up" your Research Questions and your Results? Schuler W. Huck (2000) in his seminal book entitled, *Reading Statistics and Research,* points to the importance of your audience understanding and making sense of your research in written form. Huck further states:

5.6.1

This book is designed to help people *decipher* what researchers are trying to communicate in the written or oral summaries of their investigations. Here, the goal is simply to distill meaning from the words, symbols,

tables, and figures included in the research report. To be competent in this arena, one must not only be able to decipher what's presented but also to "fill in the holes"; this is the case because researchers typically assume that those receiving the research report are familiar with unmentioned details of the research process and statistical treatment of data.

Researchers and Professors John Slate and Ana Rojas-LeBouef understand this critical issue, so often neglected or not addressed by other authors and researchers. They point to the importance of doctoral students "writing up their statistics" in a way that others can understand your reporting and as importantly, interpret the meaning of your significant findings and implications for the preparation and practice of educational leadership. Slate and LeBouef provide you with a model for "writing up your Independent Samples t -test statistics."

Click here to view: *Writing Up Your Independent Samples t-test Statistics* [27]

5.7 References

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erbaum

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Onwuegbuzie, A. J., & Daniel, L. G. (2002). Uses and misuses of the correlation coefficient. *Research in the Schools, 9*(1), 73-90.

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[27] http://cnx.org/content/col11299/latest/
[28] http://davidmlane.com/hyperstat/
[29] http://www.statistics.com/index.php?page=glossary&term_id=326
[30] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[31] http://www.statistics.com/index.php?page=glossary&term_id=356
[32] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[33] http://www.statsoft.com/textbook/

Chapter 6

Conducting a Parametric Dependent Samples t-test (Paired Samples t-test)[1]

NOTE: This chapter has been peer-reviewed, accepted, and endorsed by the National Council of Professors of Educational Administration (NCPEA) as a significant contribution to the scholarship and practice of education administration. Formatted and edited in Connexions by Theodore Creighton and Brad Bizzell, Virginia Tech, Janet Tareilo, Stephen F. Austin State University, and Thomas Kersten, Roosevelt University.

6.1

This chapter is part of a larger Collection (Book) and is available at: *Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts* [2]

NOTE: Slate and LeBouef have written a "companion book" which is available at: *Preparing and Presenting Your Statistical Findings: Model Write Ups* [3]

Authors Information

John R. Slate is a Professor at Sam Houston State University where he teaches Basic and Advanced Statistics courses, as well as professional writing, to doctoral students in Educational Leadership and Counseling. His research interests lie in the use of educational databases, both state and national, to reform school practices. To date, he has chaired and/or served over 100 doctoral student dissertation committees. Recently, Dr. Slate created a website Writing and Statistical Help[4] to assist students and faculty with both statistical assistance and in editing/writing their dissertations/theses and manuscripts.

[1] This content is available online at <http://cnx.org/content/m37328/1.6/>.
[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[3] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[4] http://www.writingandstatisticalhelp.com

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Thomas Kersten is a Professor at Roosevelt University in Chicago. Dr. Kersten is widely published and an experienced editor and is the author of Taking the Mystery Out of Illinois School Finance[8] , a Connexions Print on Demand publication. He is also serving as Editor in Residence for this book by Slate and LeBouef.

6.2 Conducting a Parametric Dependent Samples *t*-test

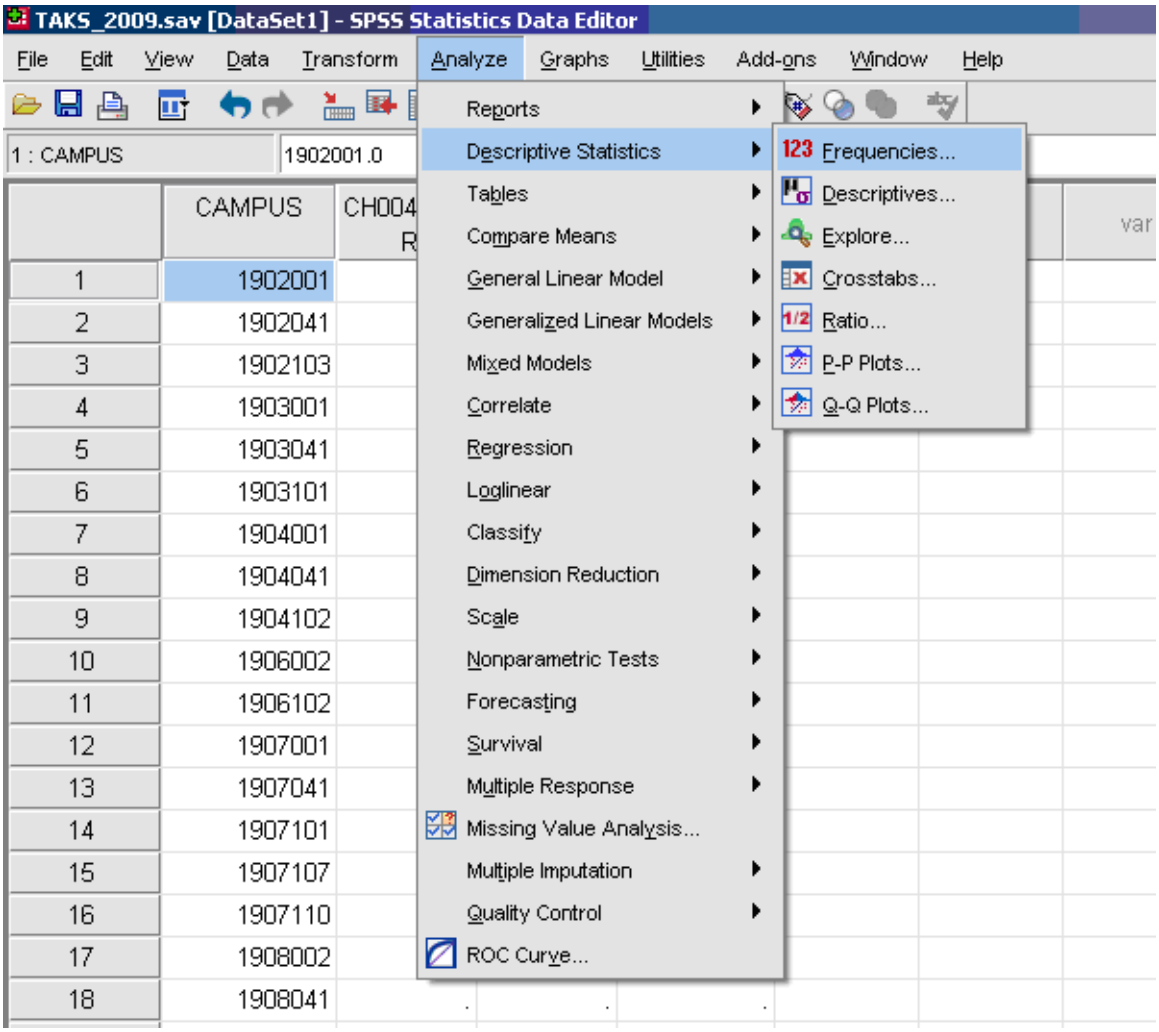
In this set of steps, readers will calculate either a parametric or a nonparametric statistical analysis, depending on whether the data for the dependent variable reflect a normal distribution. A parametric statistical procedure requires that its data be reflective of a normal curve whereas no such assumption is made in the use of a nonparametric procedure. Of the two types of statistical analyses, the parametric procedure is the more powerful one in ascertaining whether or not a statistically significant difference, in this case, exists. As such, parametric procedures are preferred over nonparametric procedures. When data are not normally distributed, however, parametric analyses may provide misleading and inaccurate results. According, nonparametric analyses should be used in cases where data are not reflective of a normal curve. In this set of steps, readers are provided with information on how to make the determination of normally or nonnormally distributed data. For detailed information regarding the assumptions underlying parametric and nonparametric procedures, readers are referred to the Hyperstats Online Statistics Textbook at http://davidmlane.com/hyperstat/[9] or to the *Electronic Statistics Textbook* (2011) at http://www.statsoft.com/textbook/[10]

For this parametric dependent samples t -test to be appropriately used, at least half of the standardized skewness coefficients and the standardized kurtosis coefficients must be within the normal range (+/-3, Onwuegbuzie & Daniel, 2002). Research questions for which dependent samples t-tests are appropriate involve asking for differences in a dependent variable by group membership (i.e., only two groups are present for t-tests and, in this case, must be connected). The research question, "What is the effect of a reading intervention program on science performance among elementary school students?" could be answered through use of an dependent samples t-test.

[5] http://www.writingandstatisticalhelp.com
[6] http://www.ncpeapublications.org
[7] http://ncpeapublications.org/about-elr.html
[8] http://cnx.org/content/col10606/latest/
[9] http://davidmlane.com/hyperstat/
[10] http://www.statsoft.com/textbook/

6.3 Step One:

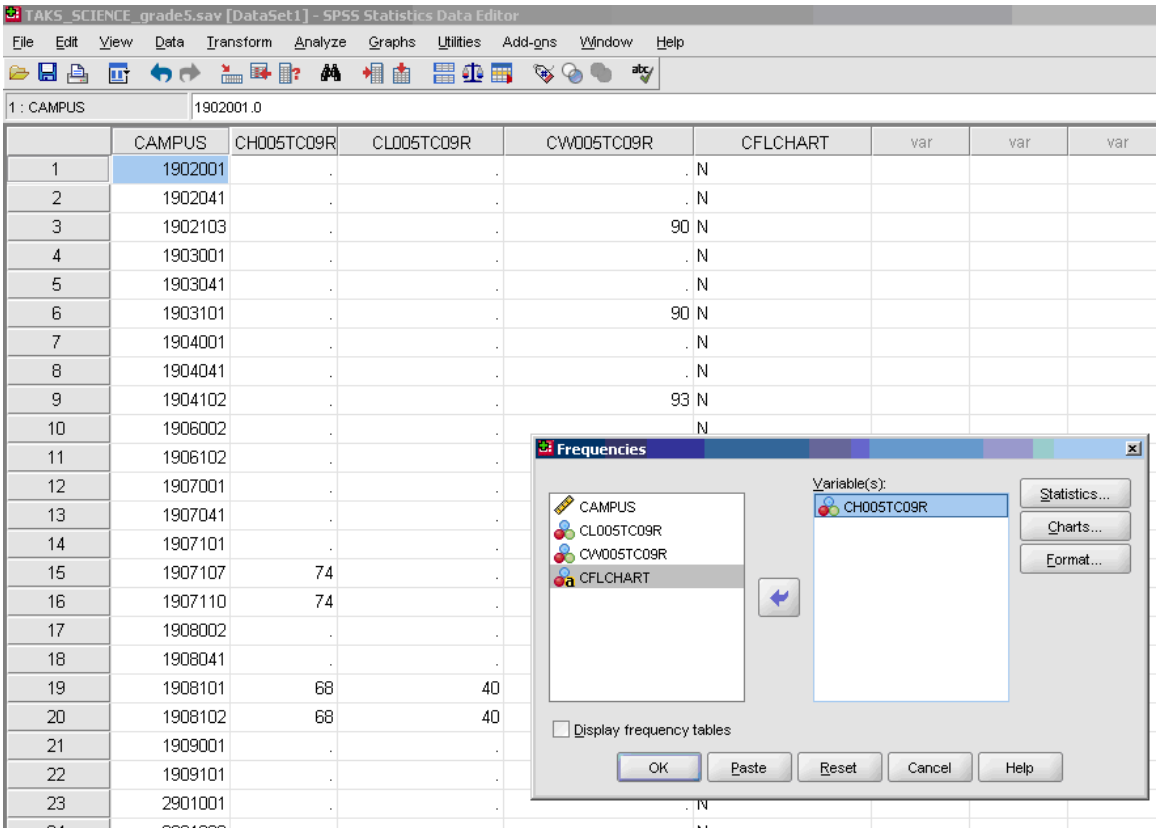
Compute Measures of Normality for the Dependent Variable
√ Analyze
* Descriptive Statistics
* Frequencies



[11]

√ Move over the dependent (outcome) variable

[11] http://cnx.org/content/m37328/latest/figure5.1.PNG/image



[12]

√ Statistics

* Skewness [Note. Skewness refers to the extent to which the data are normally distributed around the mean. Skewed data involve having either mostly high scores with a few low ones or having mostly low scores with a few high ones.] Readers are referred to the following sources for a more detailed definition of skewness: http://www.statistics.com/index.php?page=glossary&term_id=356[13] and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[14]

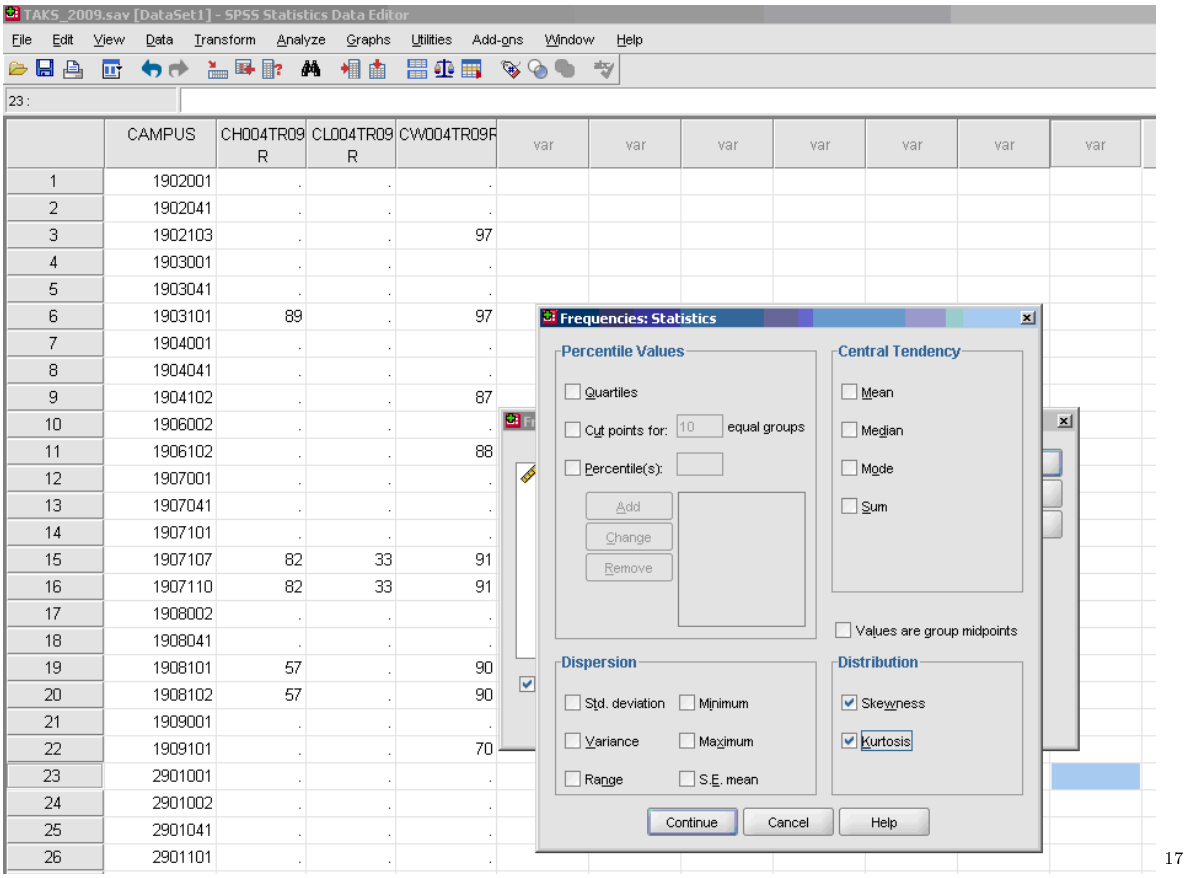
To standardize the skewness value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the skewness value from the SPSS output and divide it by the Std. error of skewness. If the resulting calculation is within -3 to +3, then the skewness of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside of this +/-3 range, the dataset is not normally distributed.

* Kurtosis [Note. Kurtosis also refers to the extent to which the data are normally distributed around the mean. This time, the data are piled up higher than normal around the mean or piled up higher than normal at the ends of the distribution.] Readers are referred to the following sources for a more detailed definition of kurtosis: http://www.statistics.com/index.php?page=glossary&term_id=326[15] and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[16]

To standardize the kurtosis value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the kurtosis value from the SPSS output and divide it by the Std. error of kurtosis. If the resulting calculation is within -3 to +3, then the kurtosis of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside

[12] http://cnx.org/content/m37328/latest/figure5.2.PNG/image
[13] http://www.statistics.com/index.php?page=glossary&term_id=356
[14] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[15] http://www.statistics.com/index.php?page=glossary&term_id=326
[16] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb

of this +/-3 range, the dataset is not normally distributed.
* Continue
* OK



17

* Uncheck the "display frequency tables" so that you are not provided with the frequencies of your data every time descriptive statistics are obtained.

6.4 Step Two:

Check for Skewness and Kurtosis values falling within/without the parameters of normality (-3 to +3). Note that each variable below has its own skewness and its own kurtosis values. Thus, a total of three standardized skewness coefficients and three standardized kurtosis coefficients can be calculated from information in the table below.

		CH005TC09R	CL005TC09R	CW005TC09R

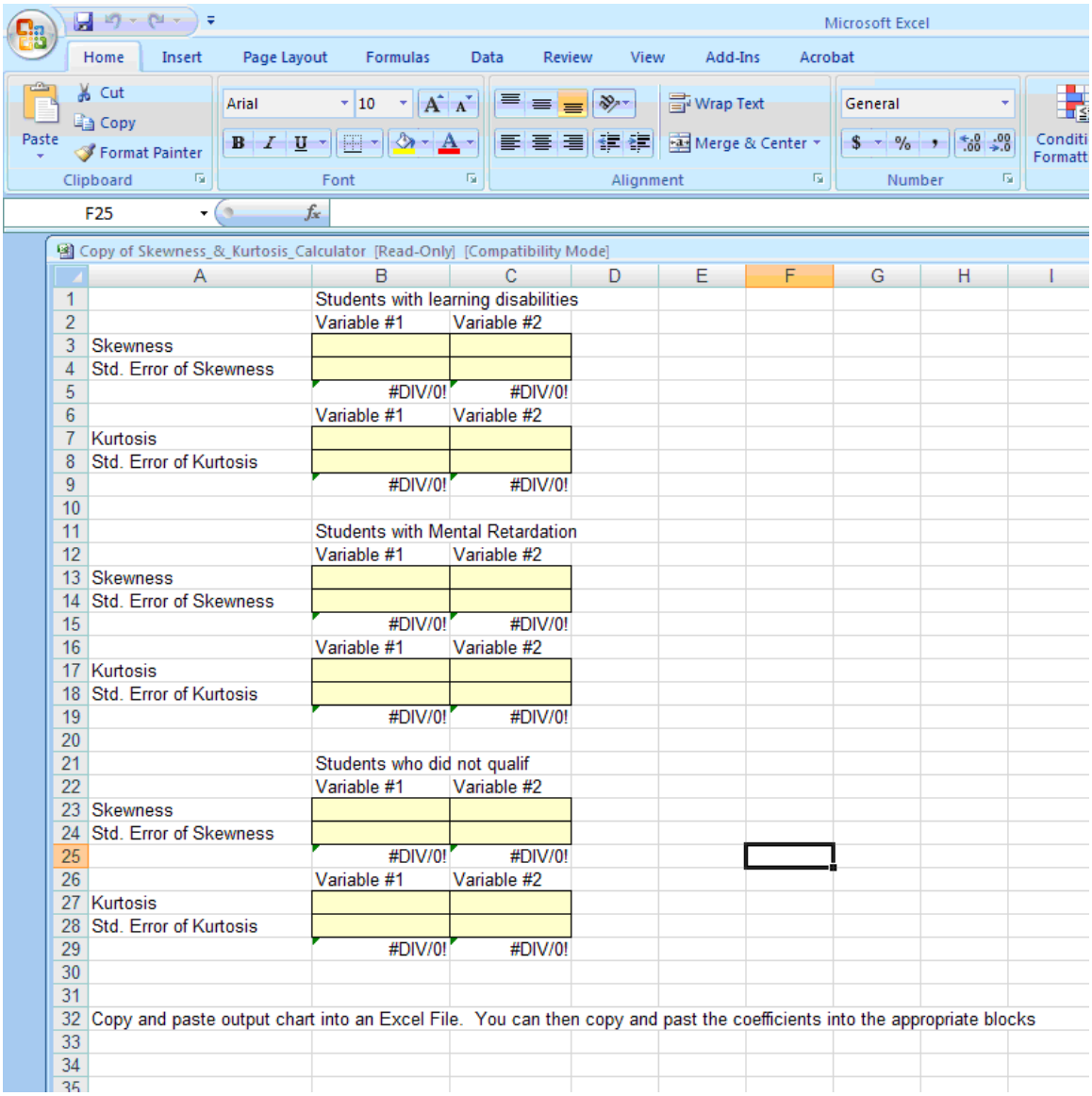
continued on next page

[17] http://cnx.org/content/m37328/latest/figure5.3.PNG/image

N	Valid	3125	1805	1877
	Missing	5197	6517	6445
Skewness		**-1.129**	**-.479**	**-2.197**
Std. Error of Skewness		**.044**	**.058**	**.056**
Kurtosis		**1.818**	**-.412**	**6.991**
Std. Error of Kurtosis		**.088**	**.115**	**.113**

Table 6.1: Skewness and Kurtosis Coefficients

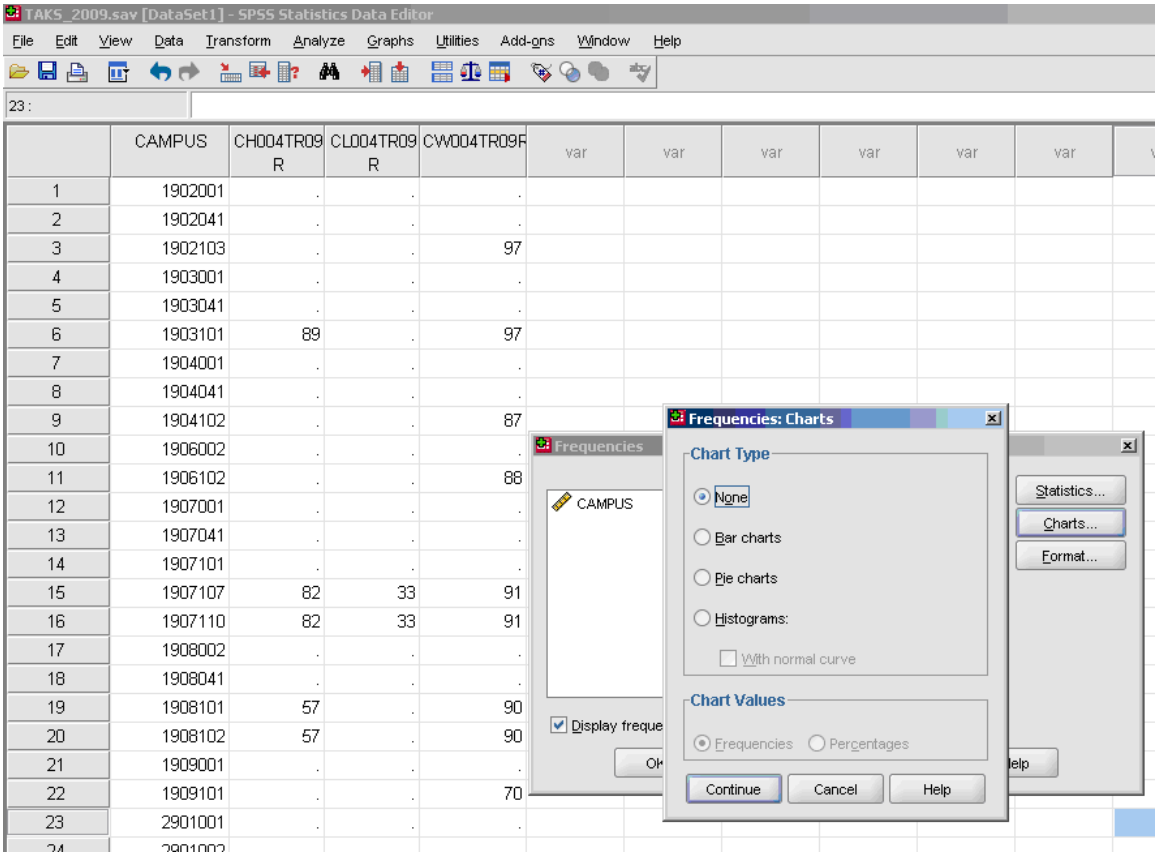
Standardized Coefficients Calculator
Copy variable #1 and #2 into the skewness and kurtosis calculator



[18]

[18] http://cnx.org/content/m37328/latest/figure5.4.PNG/image

√ Charts (these are calculated only if you wish to have visual depictions of skewness and of kurtosis-they are not required)
* Histogram∼ with normal curve (not required, optional)

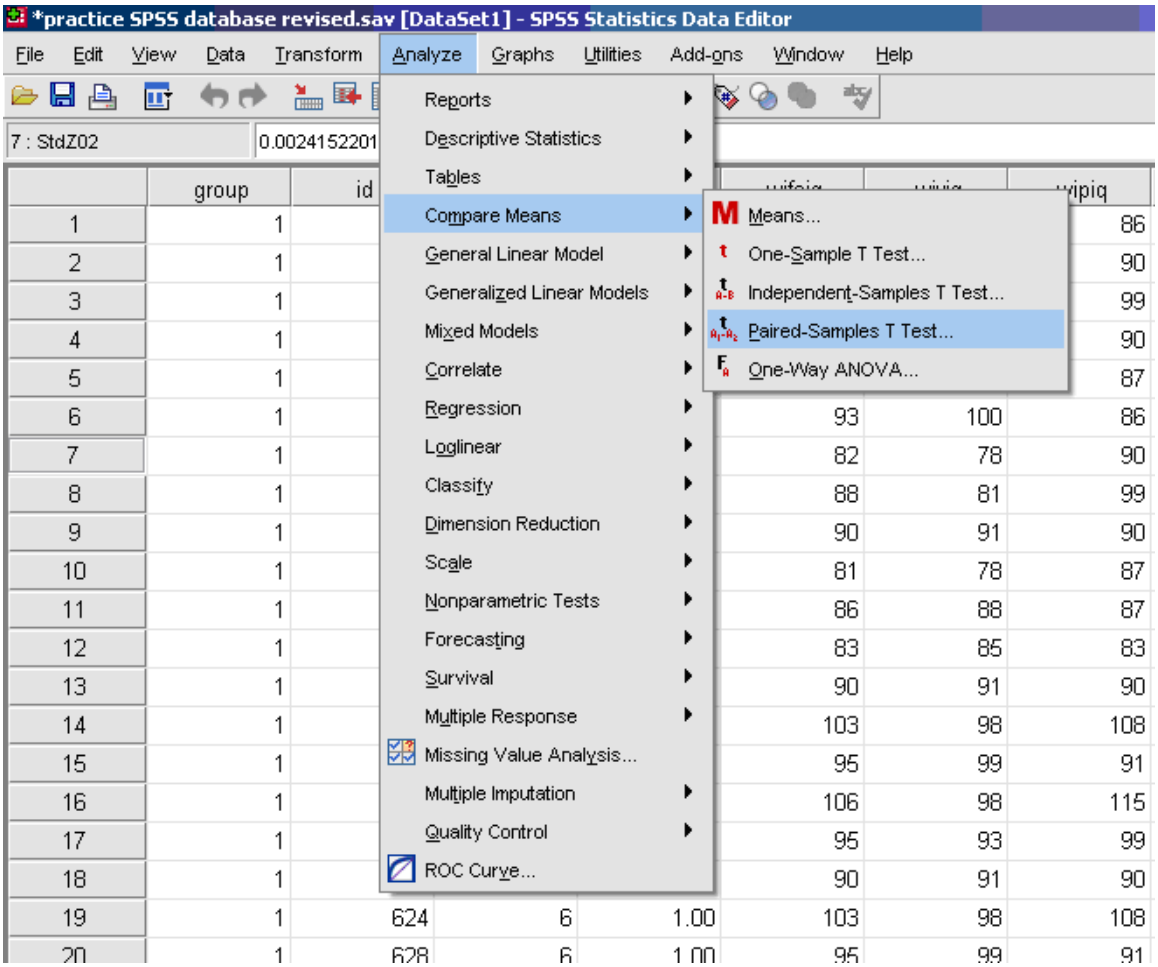


[19]

6.5 Step Three:

Calculate Paired Samples *t*-test on Data
√ Analyze
√ Compare Means
√ Paired samples *t*-test

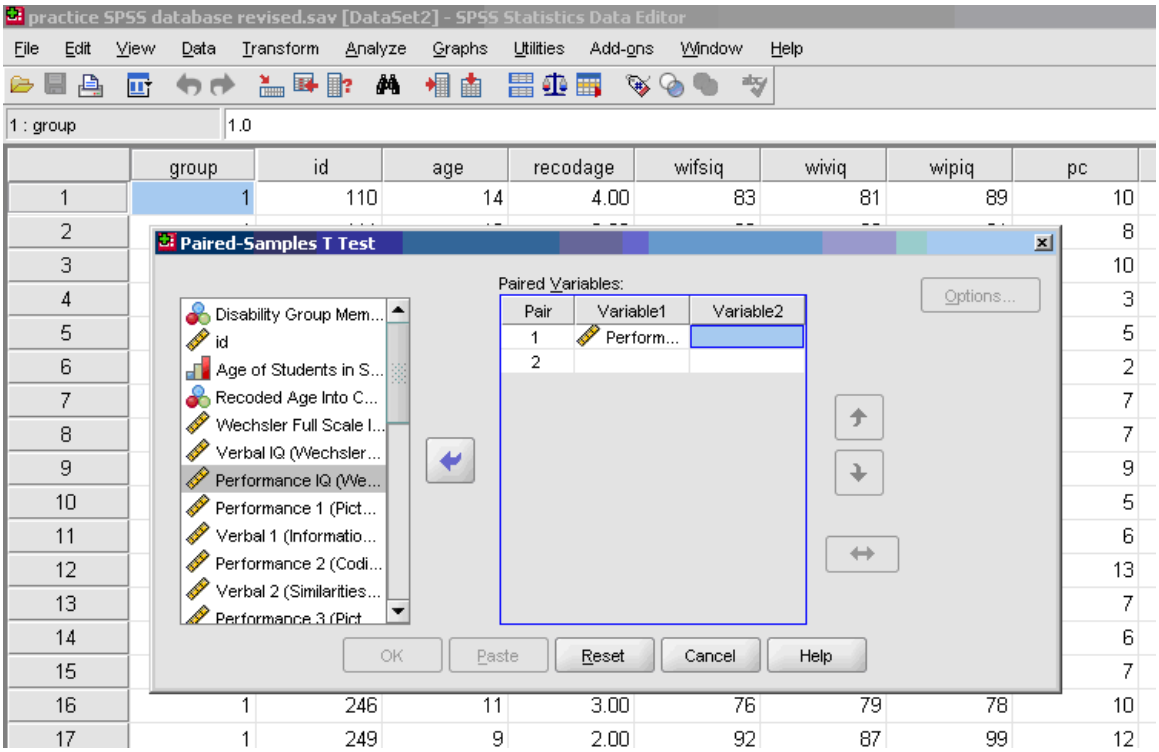
[19] http://cnx.org/content/m37328/latest/figure5.5.PNG/image



[20]

√ Click on one dependent variable
√ Arrow to send over to Paired Variables Side, Variable 1

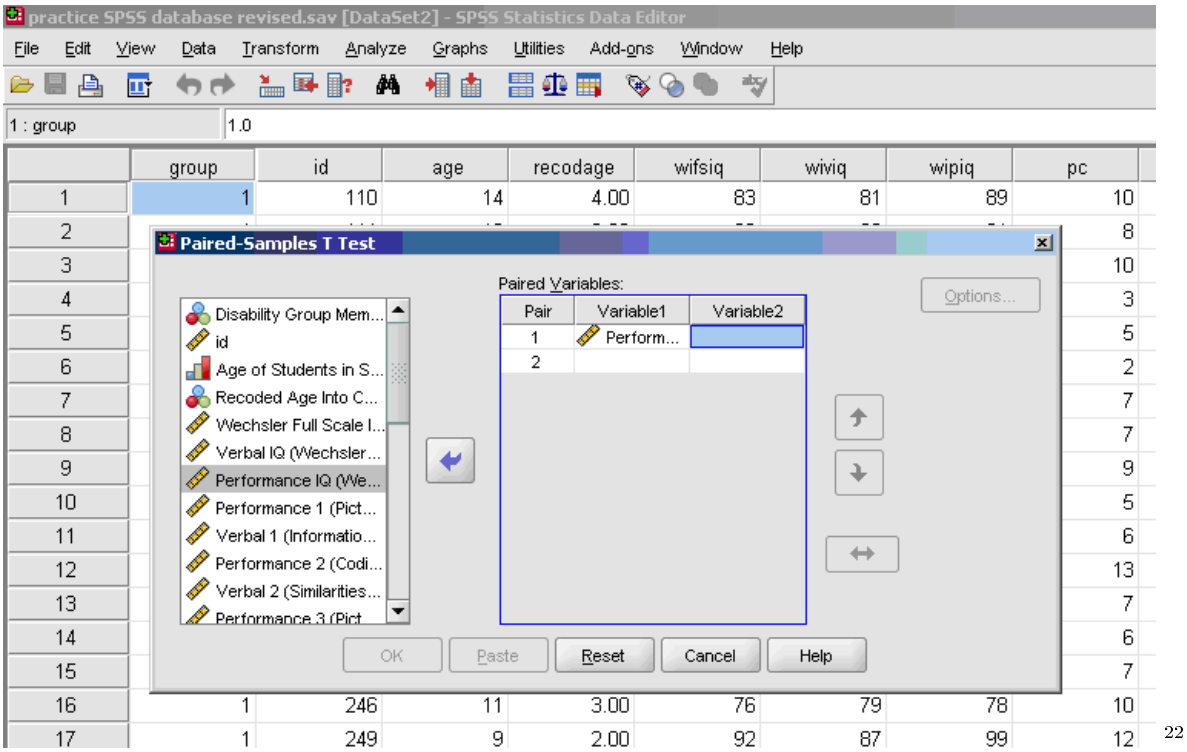
[20] http://cnx.org/content/m37328/latest/figure5.6.PNG/image



[21]

√ Click on second dependent variable
√ Arrow to send over to Paired Variables Side, Variable 2

[21] http://cnx.org/content/m37328/latest/figure5.7.1.PNG/image



[22]

√ OK

6.6 Step Four:

Check for Statistical Significance

Go to the Paired Samples Test Box and look at the very last cell labeled Sig. (2-tailed) to check for significance.

If you have any value less than .05 then you have statistical significance. Remember to replace the third zero with a 1 to a .000 value (i.e., for a value of .000, you would write it as .001).

Paired Samples Test								
Disability Group Membership	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			

continued on next page

[22] http://cnx.org/content/m37328/latest/figure5.8.1.PNG/image

Students with Learning Disabilities	Pair 1	Verbal IQ (Wechsler Verbal Intelligence 3) - Performance 1 (Picture Completion)	76.192	10.141	.464	75.281	77.104	164.266	477	.000

Table 6.2: Paired Samples Test

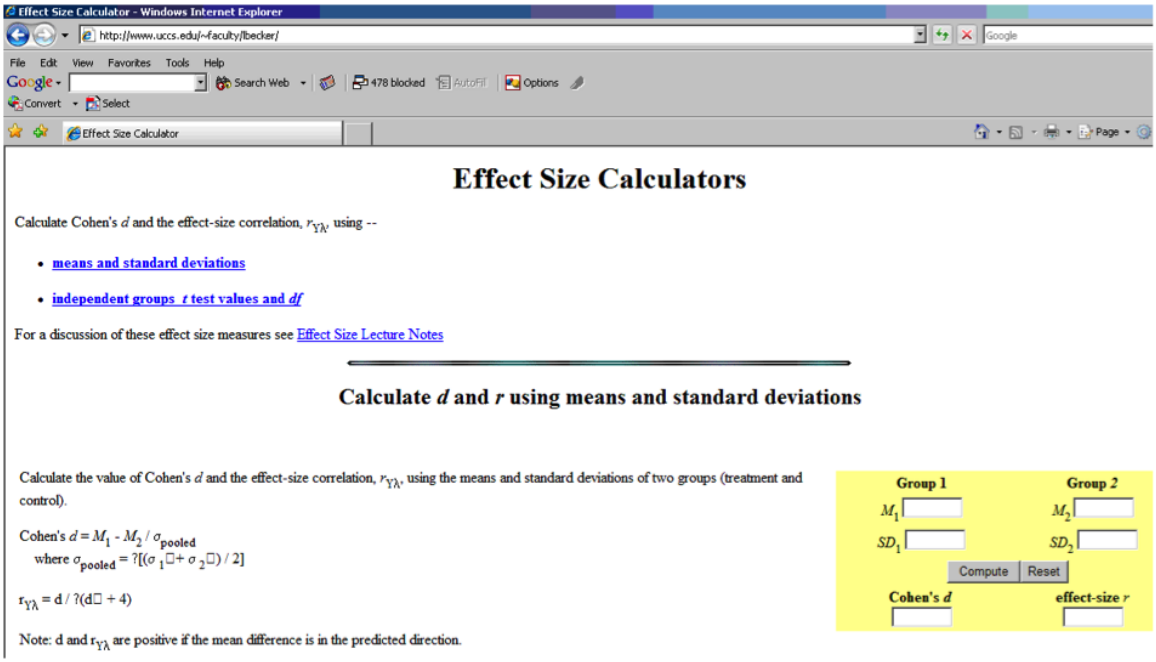
1. Numerical sentence is written as:
Numerical Sentence = $t(\mathrm{df})_{\mathrm{sp}}{=}_{\mathrm{sp}} t{,}_{\mathrm{sp}} p_{\mathrm{sp}}{<}_{\mathrm{sp}} .001$ (or Bonferroni-adjusted alpha).
- *df* is located in Paired Samples Box
- t is located in Paired Samples Box
2. The outcome of the paired samples t-test, $t(477) = 164.27$ $p < .001$, was statistically significant.

6.7 Step Five:

Check for Effect Size
* Use the web-based calculator for effect size using the following websites:
Effect Size Calculators for Basic and Multivariate Statistical Procedures[23]

Cohen's d (1988)
d of 0.20 = small effect size (range 0.20 to 0.49)
d of 0.50 = moderate effect size (range 0.50 to 0.79)
d of 0.80 = large effect size (range 0.80 and above)
Note. Cohen's d can be greater than 1.00. Therefore, a 0 should be placed in front of the decimal when the value is lower than 1.00.

[23] http://www.uccs.edu/~faculty/lbecker/



6.8 Step Six:

Narrative and Interpretation

1. type of *t*-test conducted and assumptions met
2. *t* value
3. degrees of freedom
4. *p* value

6.9 Writing Up Your Statistics

So, how do you "write up" your Research Questions and your Results? Schuler W. Huck (2000) in his seminal book entitled, *Reading Statistics and Research*, points to the importance of your audience understanding and making sense of your research in written form. Huck further states:

6.9.1

This book is designed to help people *decipher* what researchers are trying to communicate in the written or oral summaries of their investigations. Here, the goal is simply to distill meaning from the words, symbols, tables, and figures included in the research report. To be competent in this arena, one must not only be able to decipher what's presented but also to "fill in the holes"; this is the case because researchers typically assume that those receiving the research report are familiar with unmentioned details of the research process and statistical treatment of data.

Researchers and Professors John Slate and Ana Rojas-LeBouef understand this critical issue, so often neglected or not addressed by other authors and researchers. They point to the importance of doctoral students "writing up their statistics" in a way that others can understand your reporting and as importantly, interpret the meaning of your significant findings and implications for the preparation and practice of educational leadership. Slate and LeBouef provide you with a model for "writing up your parametric dependent sample t-test statistics."

Click here to view: *Writing Up Your Parametric Dependent Samples t-test Statistics* [24]

6.10 References

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Onwuegbuzie, A. J., & Daniel, L. G. (2002). Uses and misuses of the correlation coefficient. *Research in the Schools, 9*(1), 73-90.

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StatSoft, Inc. (2011). *Electronic statistics textbook*. Tulsa, OK: StatSoft. WEB: http://www.statsoft.com/textbook/[30]

[24] http://cnx.org/content/col11299/latest/
[25] http://davidmlane.com/hyperstat/
[26] http://www.statistics.com/index.php?page=glossary&term_id=326
[27] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
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[29] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[30] http://www.statsoft.com/textbook/

Chapter 7

Conducting a Nonparametric Independent Samples t-test[1]

NOTE: This Chapter has been peer-reviewed, accepted, and endorsed by the National Council of Professors of Educational Administration (NCPEA) as a significant contribution to the scholarship and practice of education administration. Formatted and edited in Connexions by Theodore Creighton and Brad Bizzell, Virginia Tech, Janet Tareilo, Stephen F. Austin State University, and Thomas Kersten, Roosevelt University.

7.1

This chapter is part of a larger Collection (Book) and is available at: *Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts* [2]

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[1] This content is available online at <http://cnx.org/content/m37330/1.6/>.
[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[3] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[4] http://www.writingandstatisticalhelp.com

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7.2 Conducting a Nonparametric Independent Samples *t*-test

In this set of steps, readers will calculate either a parametric or a nonparametric statistical analysis, depending on whether the data for the dependent variable reflect a normal distribution. A parametric statistical procedure requires that its data be reflective of a normal curve whereas no such assumption is made in the use of a nonparametric procedure. Of the two types of statistical analyses, the parametric procedure is the more powerful one in ascertaining whether or not a statistically significant difference, in this case, exists. As such, parametric procedures are preferred over nonparametric procedures. When data are not normally distributed, however, parametric analyses may provide misleading and inaccurate results. According, nonparametric analyses should be used in cases where data are not reflective of a normal curve. In this set of steps, readers are provided with information on how to make the determination of normally or nonnormally distributed data. For detailed information regarding the assumptions underlying parametric and nonparametric procedures, readers are referred to the Hyperstats Online Statistics Textbook at http://davidmlane.com/hyperstat/ or to the Electronic Statistics Textbook (2011) at http://www.statsoft.com/textbook/

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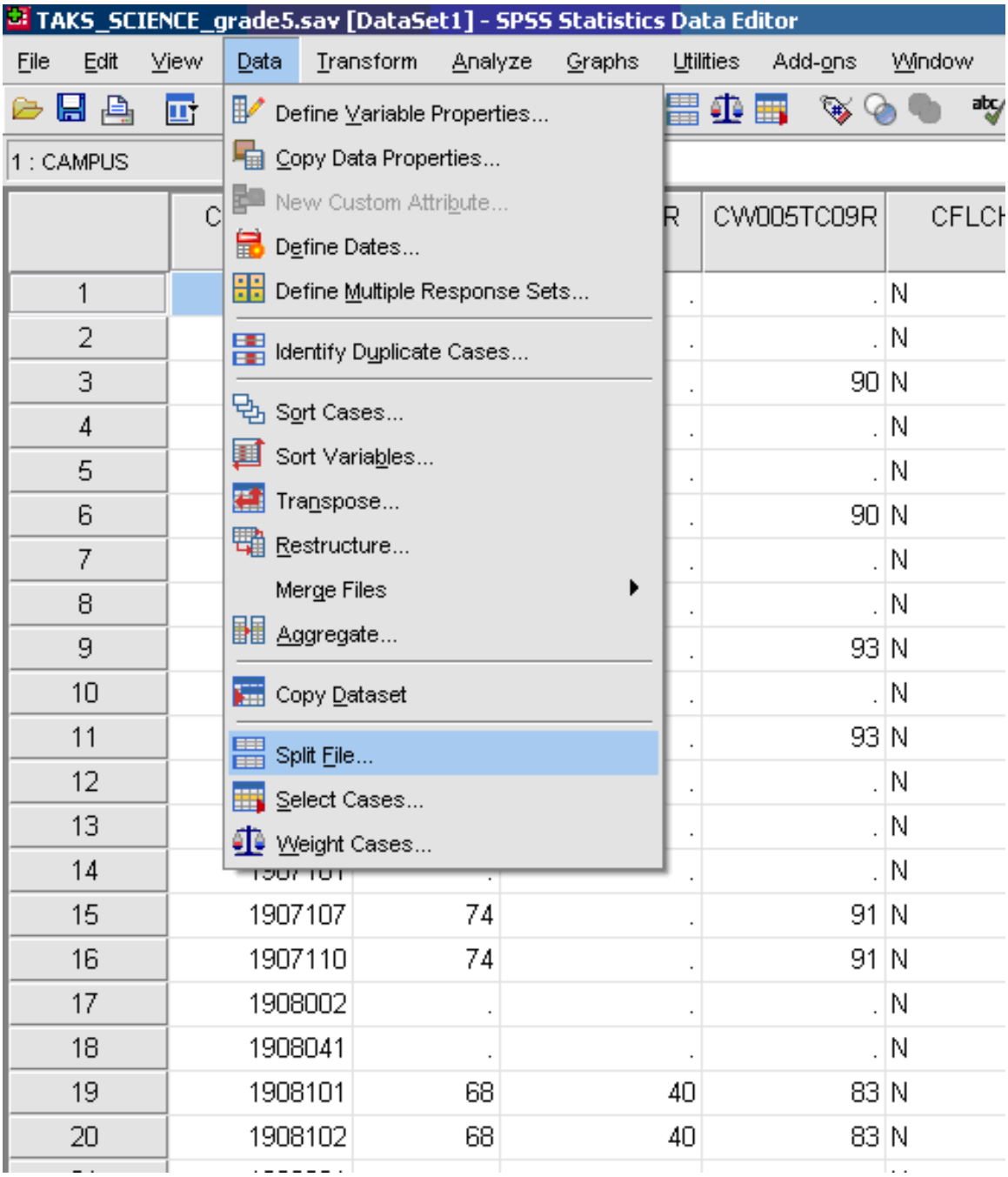
[5] http://www.writingandstatisticalhelp.com
[6] http://www.ncpeapublications.org
[7] http://ncpeapublications.org/about-elr.html
[8] http://cnx.org/content/col10606/latest/

7.3 Step One:

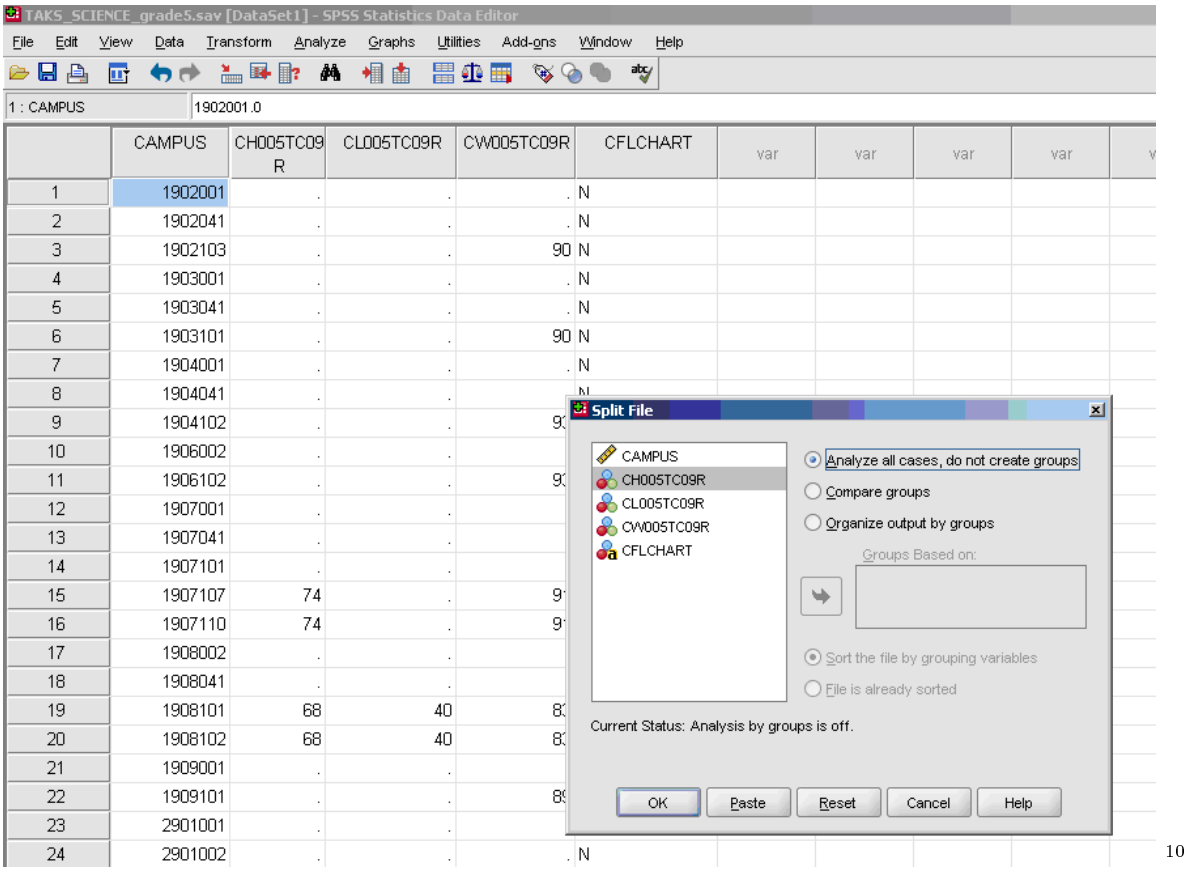
Calculate Frequencies on the Split Groups
√ Data
* Split File



[9]

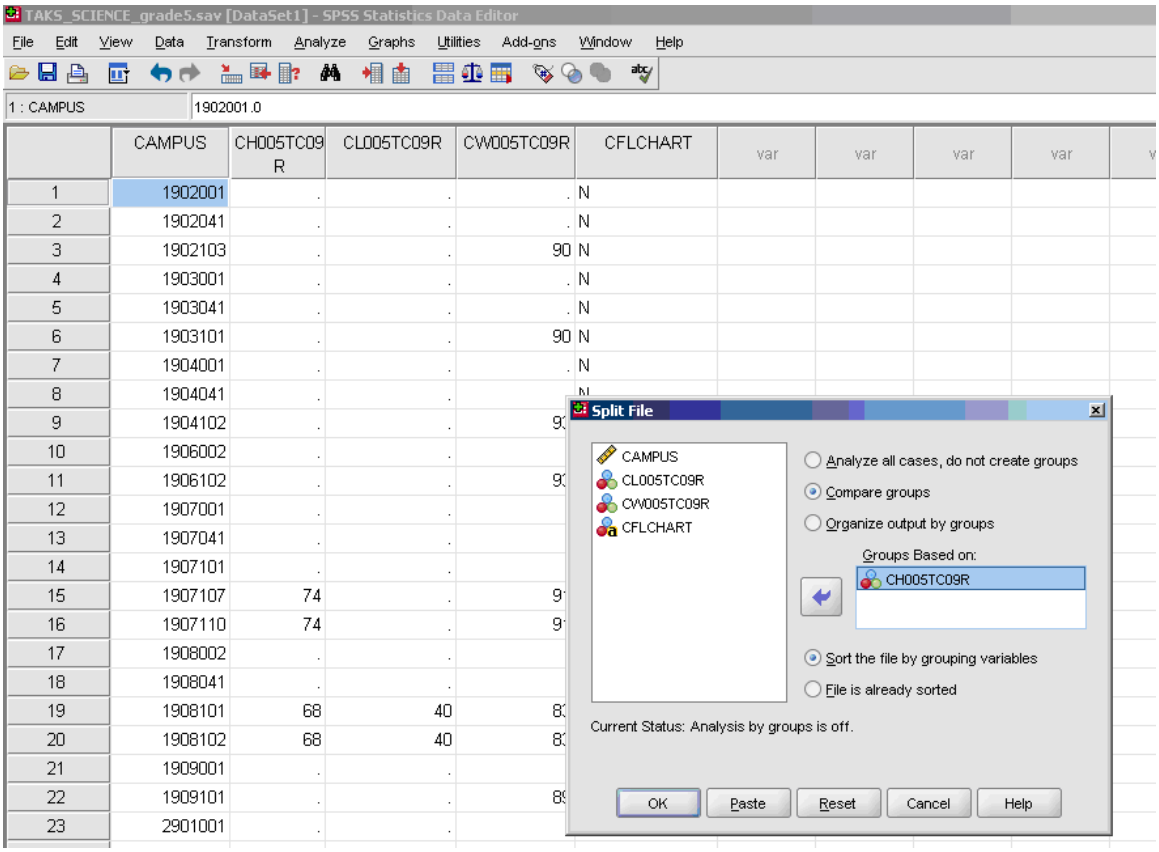
Your screen will show that all cases are going to be analyzed and a "do not create groups". You will need to click the compare groups and move the independent variable over to the "Group Based on".

[9] http://cnx.org/content/m37330/latest/figure6.1.PNG/image



After you do this, your screen should resemble the following:

[10] http://cnx.org/content/m37330/latest/figure6.2.PNG/image



[11]

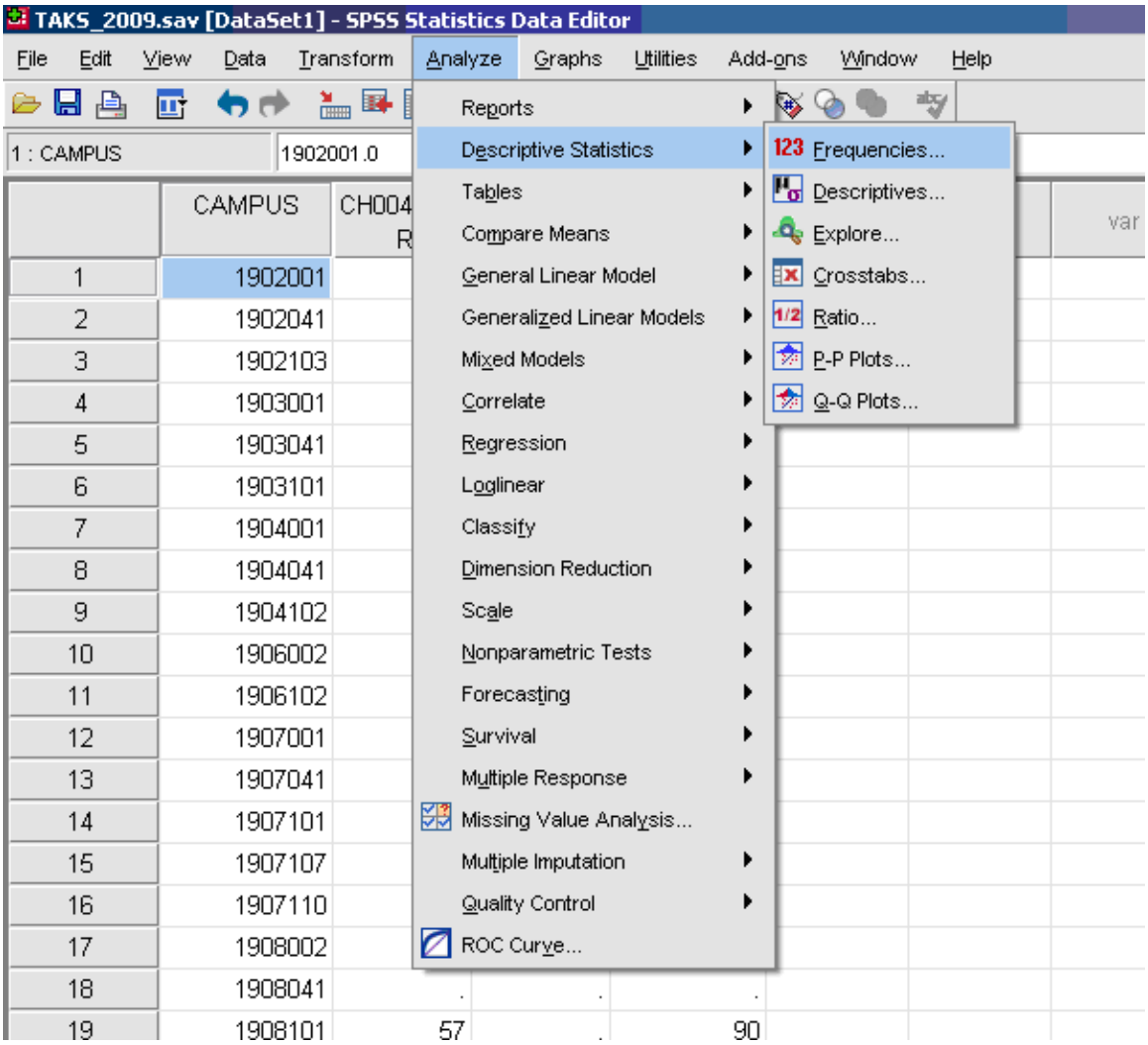
Then click OK

√ Analyze

* Descriptive Statistics

* Frequencies

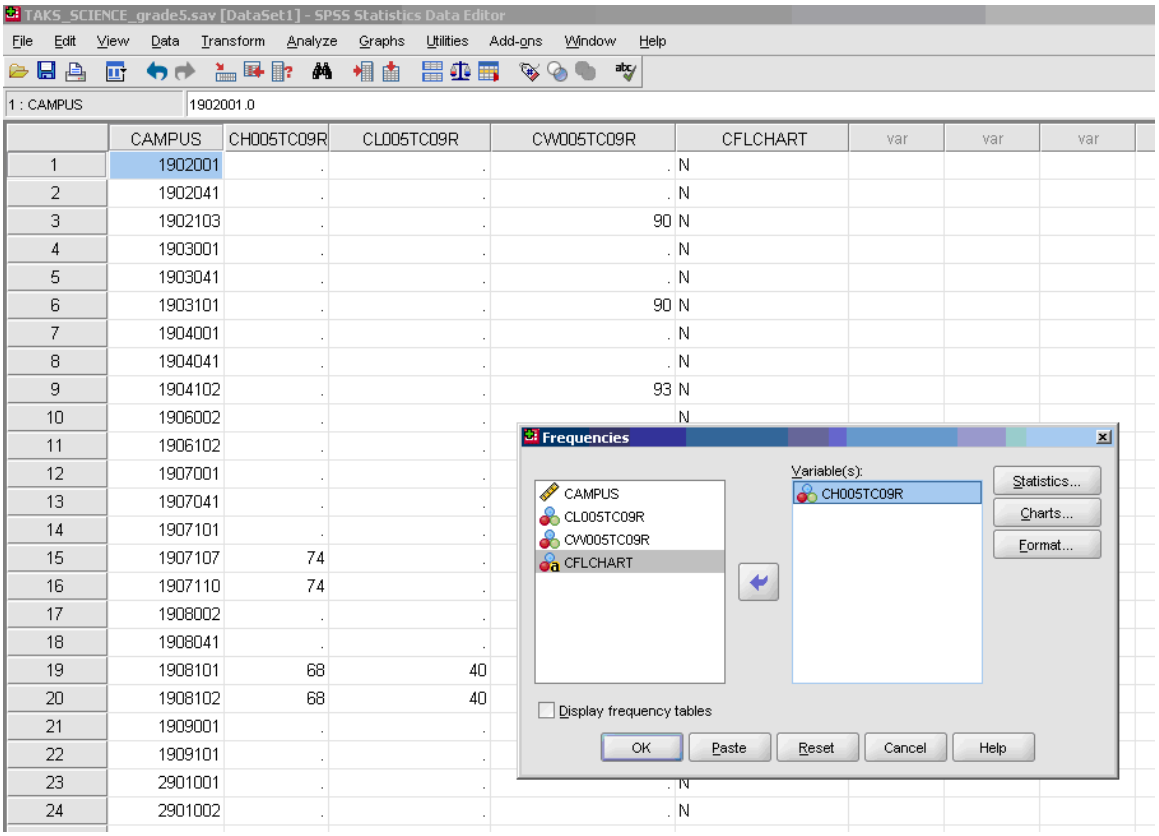
[11] http://cnx.org/content/m37330/latest/figure6.3.PNG/image



[12]

√ Move over the dependent (outcome) variable

[12] http://cnx.org/content/m37330/latest/figure6.4.PNG/image



[13]

√ Statistics
* Mean
* Standard Deviation
* Skewness [Note. Skewness refers to the extent to which the data are normally distributed around the mean. Skewed data involve having either mostly high scores with a few low ones or having mostly low scores with a few high ones.] Readers are referred to the following sources for a more detailed definition of skewness:

http://www.statistics.com/index.php?page=glossary&term_id=356[14]
http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[15]

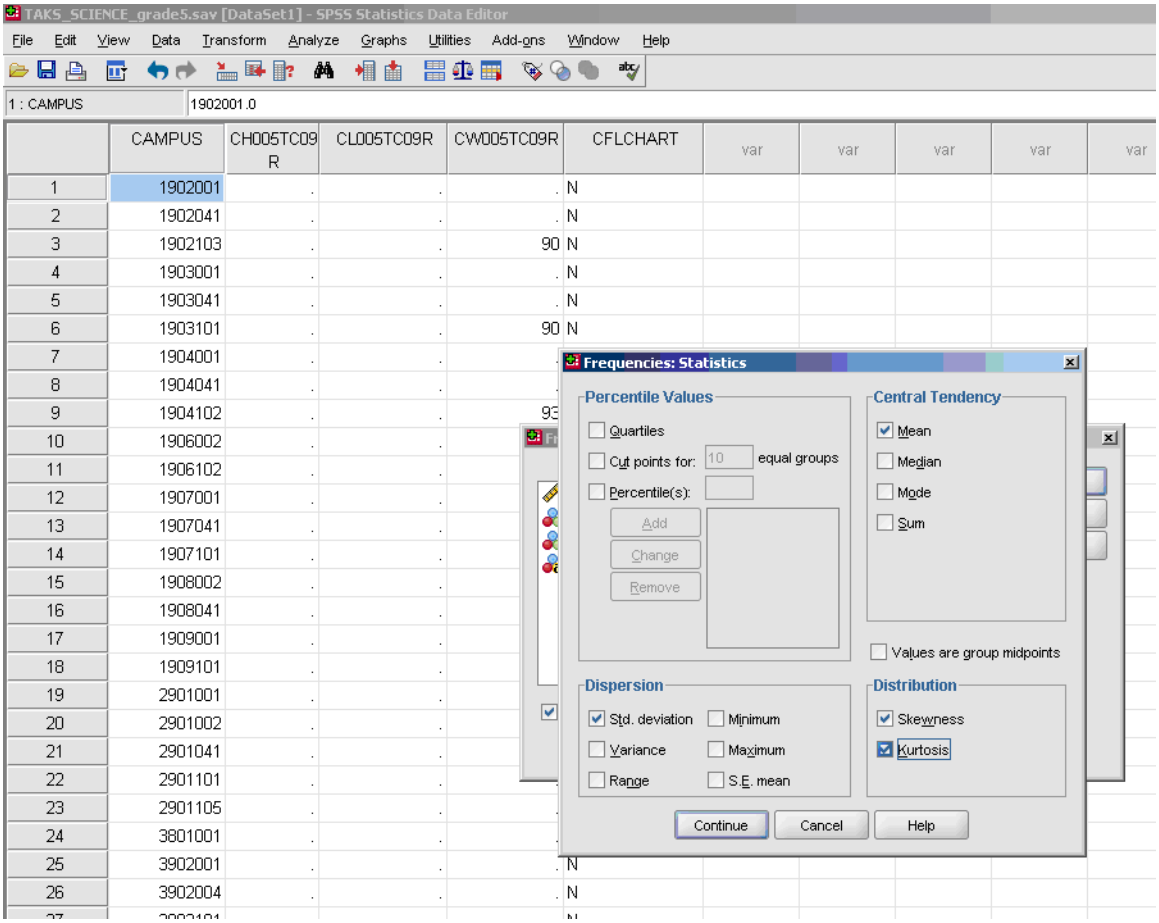
To standardize the skewness value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the skewness value from the SPSS output and divide it by the Std. error of skewness. If the resulting calculation is within -3 to +3, then the skewness of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside of this +/-3 range, the dataset is not normally distributed.

* Kurtosis [Note. Kurtosis also refers to the extent to which the data are normally distributed around the mean. This time, the data are piled up higher than normal around the mean or piled up higher than normal at the ends of the distribution.] Readers are referred to the following sources for a more detailed definition of kurtosis:

To standardize the kurtosis value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the kurtosis value from the SPSS output and divide it by the Std. error of kurtosis. If the resulting calculation is within -3 to +3, then the kurtosis of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside

[13] http://cnx.org/content/m37330/latest/figure6.5.PNG/image
[14] http://www.statistics.com/index.php?page=glossary&term_id=356
[15] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb

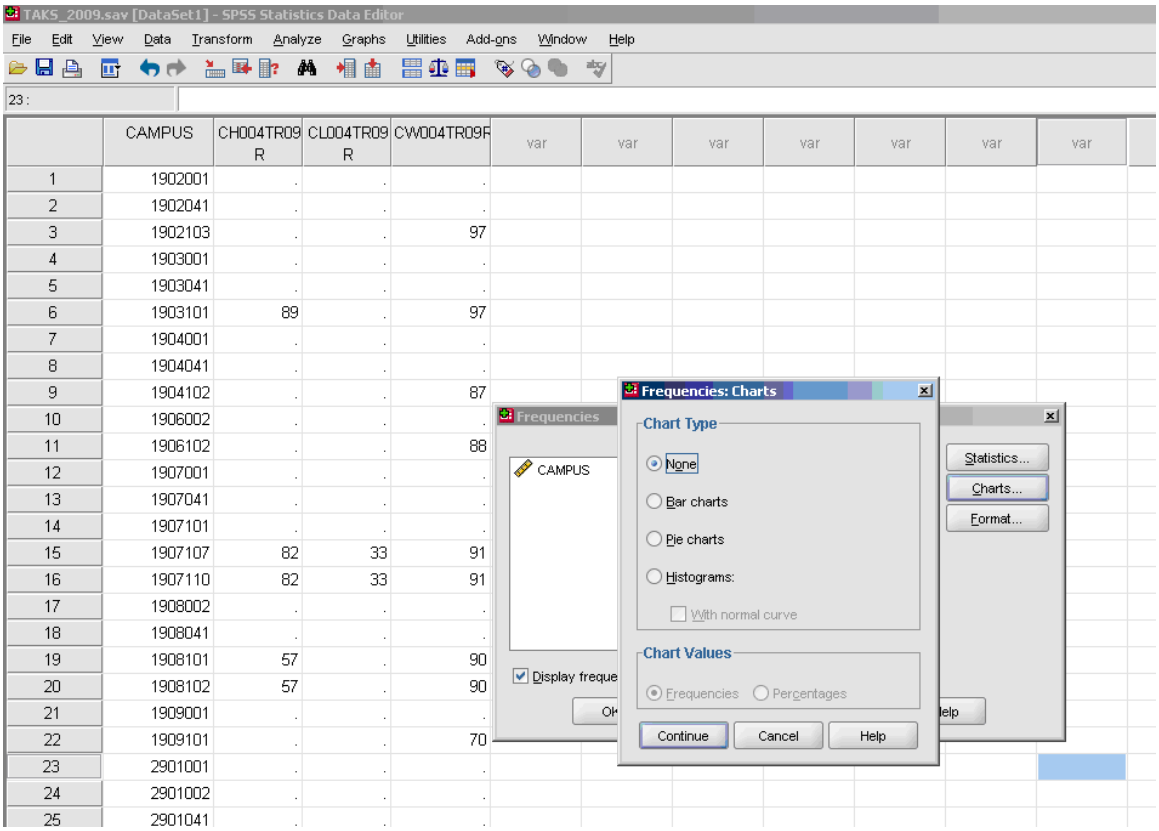
of this +/-3 range, the dataset is not normally distributed.
http://www.statistics.com/index.php?page=glossary&term_id=326[16]
http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[17]
* Continue
* OK



[18]

√ Charts (these are calculated only if you wish to have visual depictions of skewness and of kurtosis-they are not required)
* Histogram~ with normal curve (not required, optional)
√ Continue
√ OK

[16] http://www.statistics.com/index.php?page=glossary&term_id=326
[17] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[18] http://cnx.org/content/m37330/latest/figure6.6.PNG/image

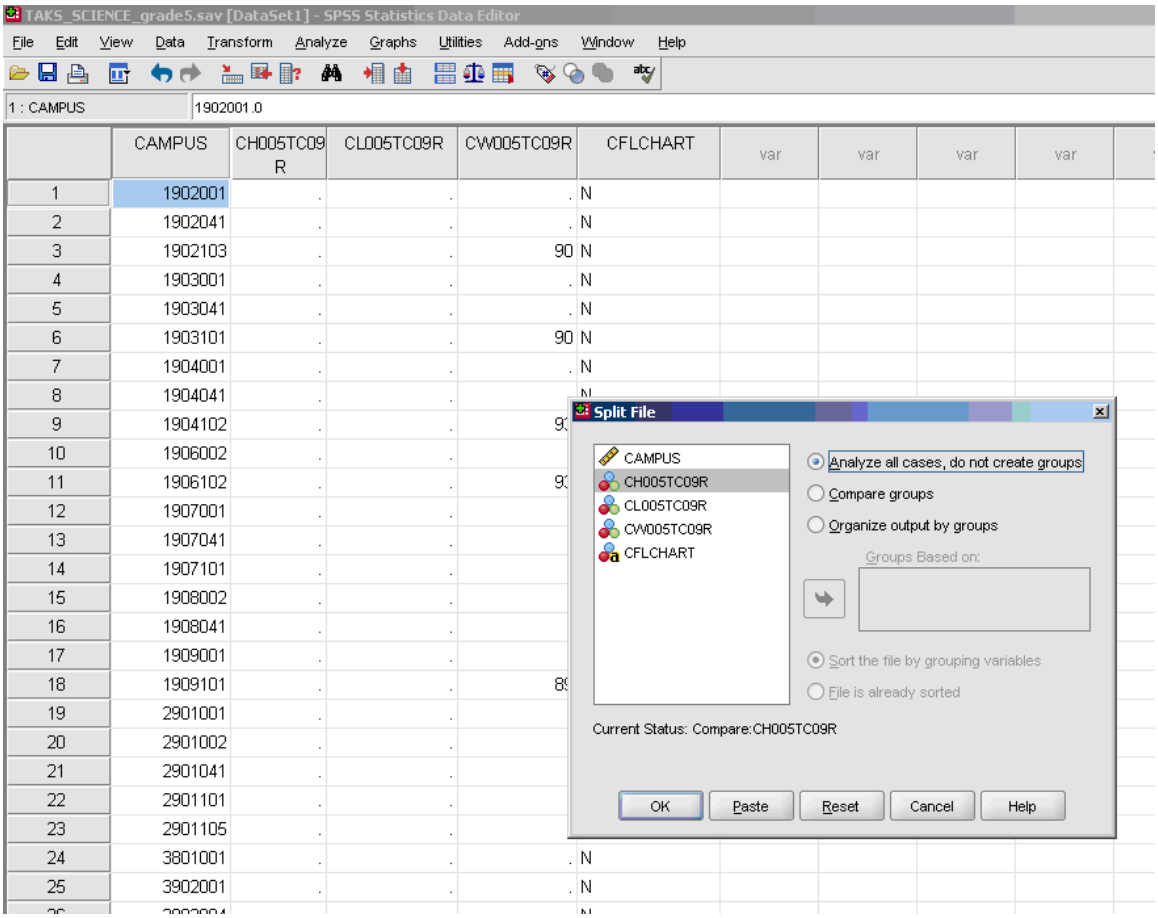


[19]

Note: Before you continue to another application you must complete the following:

√ Data
√ Split Files
√ Analyze all cases, do not create groups
√ OK

[19] http://cnx.org/content/m37330/latest/figure6.7.PNG/image



[20]

7.4 Step Two:

Check for Skewness and Kurtosis values falling within/without the parameters of normality (-3 to +3). Note that each variable has its own skewness value and its own kurtosis value. Thus, a total of three standardized skewness coefficients and three standardized kurtosis coefficients can be calculated from information in the table below.

		CH005TC09R	CL005TC09R	CW005TC09R
N	Valid	3125	1805	1877
	Missing	5197	6517	6445

continued on next page

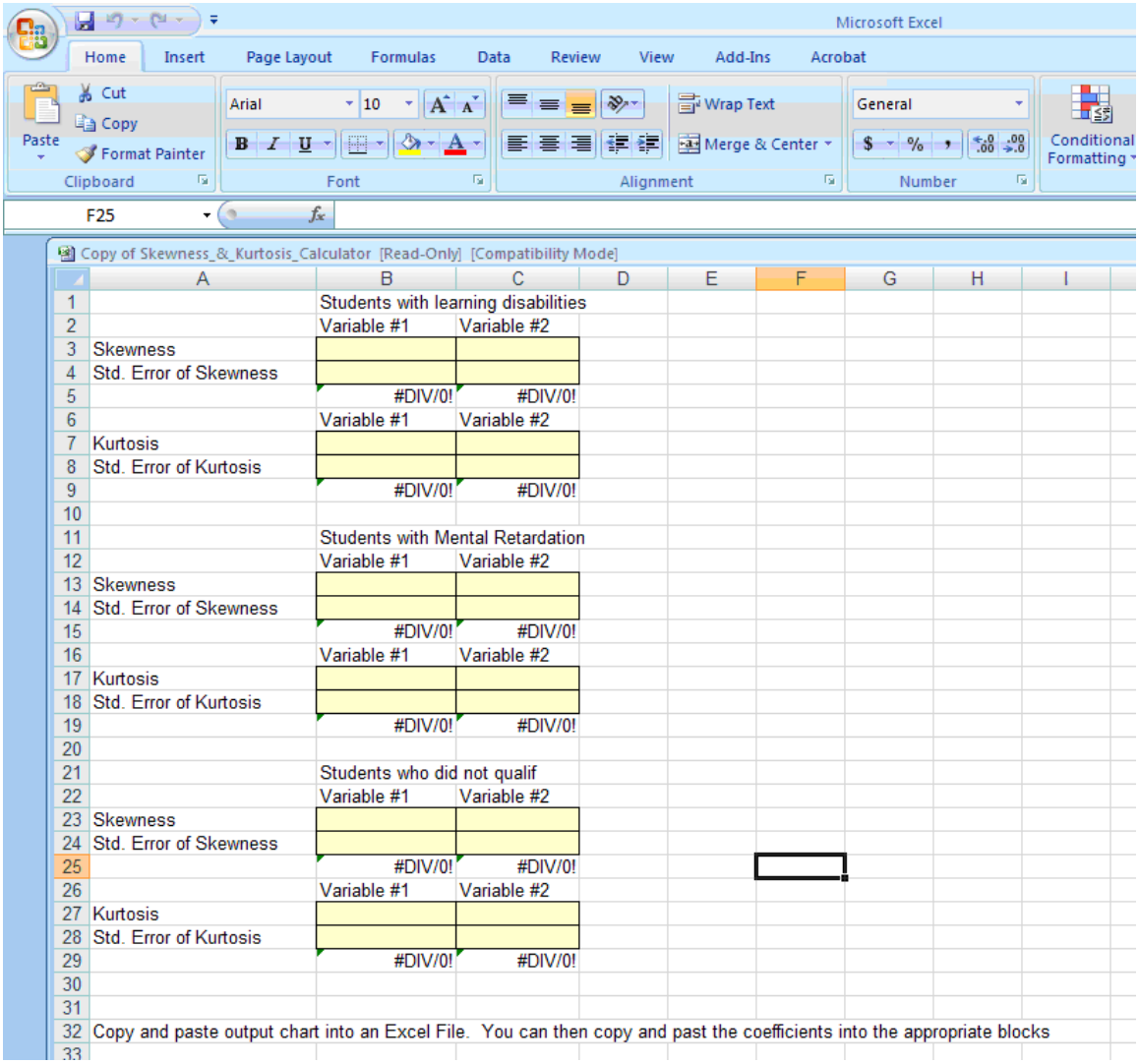
[20] http://cnx.org/content/m37330/latest/figure6.8.PNG/image

Skewness	**-1.129**	**-.479**	**-2.197**
Std. Error of Skewness	**.044**	**.058**	**.056**
Kurtosis	**1.818**	**-.412**	**6.991**
Std. Error of Kurtosis	**.088**	**.115**	**.113**

Table 7.1: Skewness and Kurtosis Coefficients

Standard Coefficients Calculator

Copy variable #1 and #2 into the skewness and kurtosis calculator



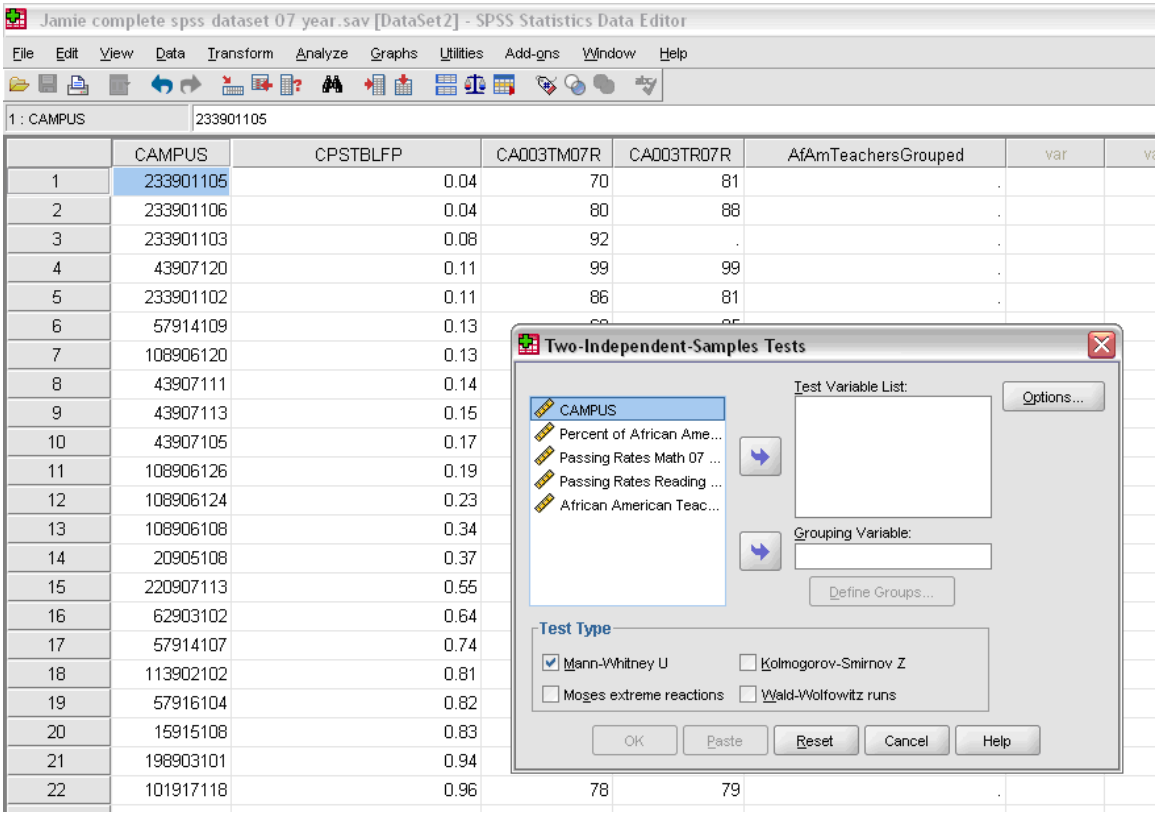
[21]

7.5 Step Three

Calculate Nonparametric Independent Samples *t*-test on Data

[21] http://cnx.org/content/m37330/latest/figure6.9.PNG/image

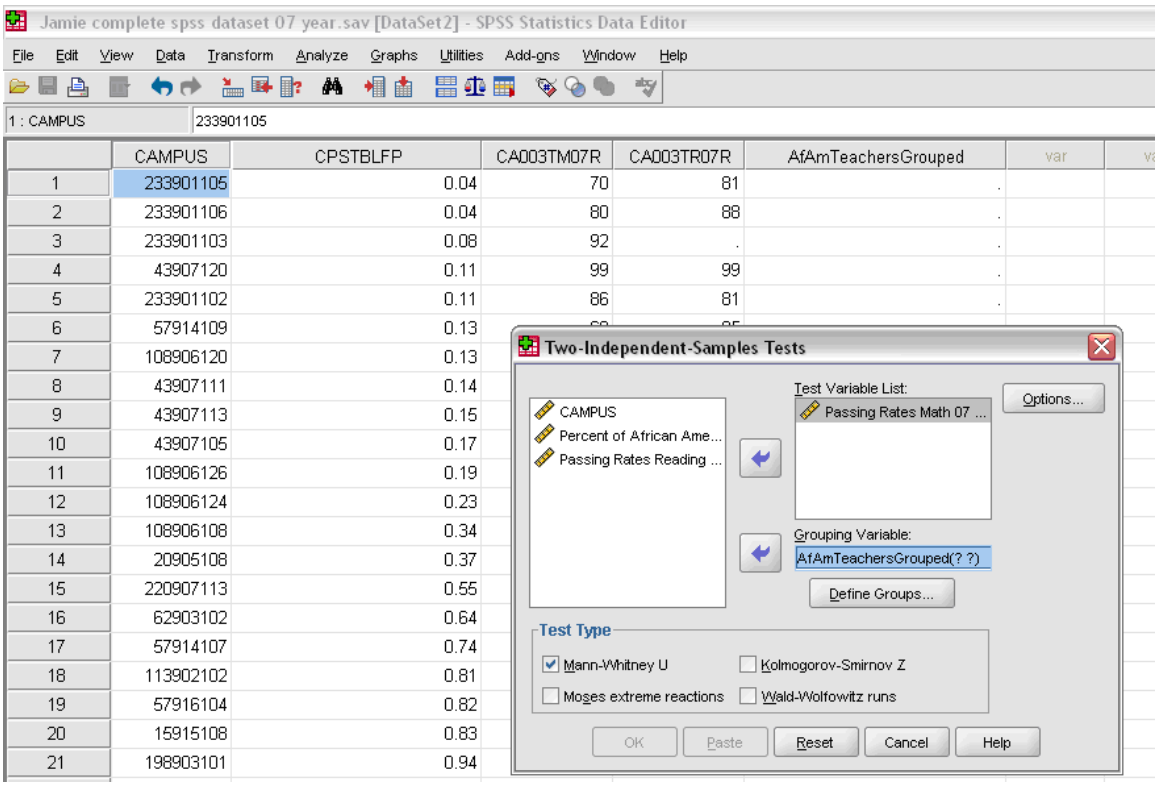
√ Analyze
√ Nonparametric Tests
√ 2 Independent Samples
√ Test Variable would be your Dependent Variable (e.g., test scores)
√ Grouping Variable would be your dichotomous Independent Variable



[22]

√ Define Groups
√ Group One is No. 1 and Group Two is No. 2 (or whatever numbers you used to identify each group)
Note: Click on view than value labels to find the code for each group.
√ Continue
√ OK

[22] http://cnx.org/content/m37330/latest/figure6.10.1.PNG/image



[23]

7.6 Step Four:

Check for Statistical Significance

Test Statistics[a]

	Performance IQ(Wechsler Performance Intelligence 3)
Mann-Whitney U	6765.500
Wilcoxon W	44166.500
Z	-20.752
Asymp. Sig. (2-tailed)	.000

Table 7.2

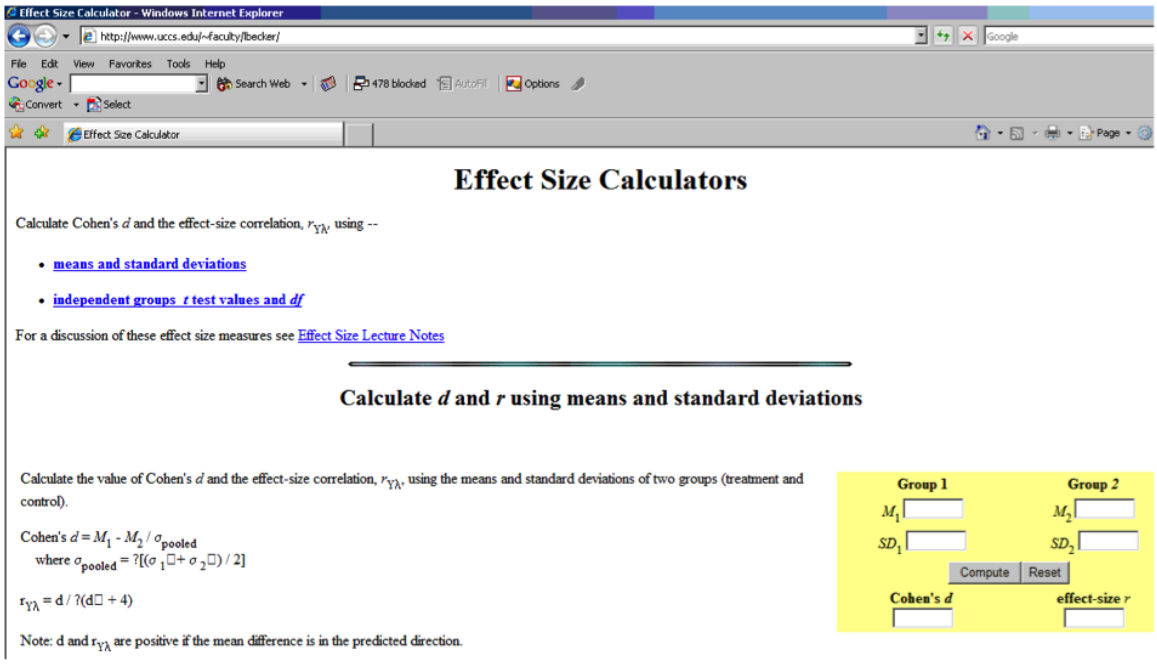
a. Grouping Variable:Disability Group Membership

Numerical sentence is written as: $U = 6765.50$, $p < .001$

[23] http://cnx.org/content/m37330/latest/figure6.11.1.PNG/image

7.7 Step Five:

Check for Effect Size
* Use the web-based calculator for effect size using the following websites:
Effect Size Calculators for Basic and Multivariate Statistical Procedures[24]



[25]

7.8 Write Up Your Statistics

So, how do you "write up" your Research Questions and your Results? Schuler W. Huck (2000) in his seminal book entitled, *Reading Statistics and Research,* points to the importance of your audience understanding and making sense of your research in written form. Huck further states:

7.8.1

This book is designed to help people *decipher* what researchers are trying to communicate in the written or oral summaries of their investigations. Here, the goal is simply to distill meaning from the words, symbols, tables, and figures included in the research report. To be competent in this arena, one must not only be able to decipher what's presented but also to "fill in the holes"; this is the case because researchers typically assume that those receiving the research report are familiar with unmentioned details of the research process and statistical treatment of data.

Researchers and Professors John Slate and Ana Rojas-LeBouef understand this critical issue, so often neglected or not addressed by other authors and researchers. They point to the importance of doctoral students "writing up their statistics" in a way that others can understand your reporting and as importantly, interpret the meaning of your significant findings and implications for the preparation and practice of educational leadership. Slate and LeBouef provide you with a model for "writing up your nonparametric independent samples *t*-test statistics."

Click here to view: *Writing Up Your Nonparametric Independent Samples t-test Statistics* [26]

[24] http://www.uccs.edu/~faculty/lbecker/
[25] http://cnx.org/content/m37330/latest/figure6.12.png/image
[26] http://cnx.org/content/col11299/latest/

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Hyperstats Online Statistics Textbook. (n.d.) Retrieved from http://davidmlane.com/hyperstat/[27]

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[32] http://www.statsoft.com/textbook/

Chapter 8

Conducting a Nonparametric Paired Samples t-test[1]

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[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
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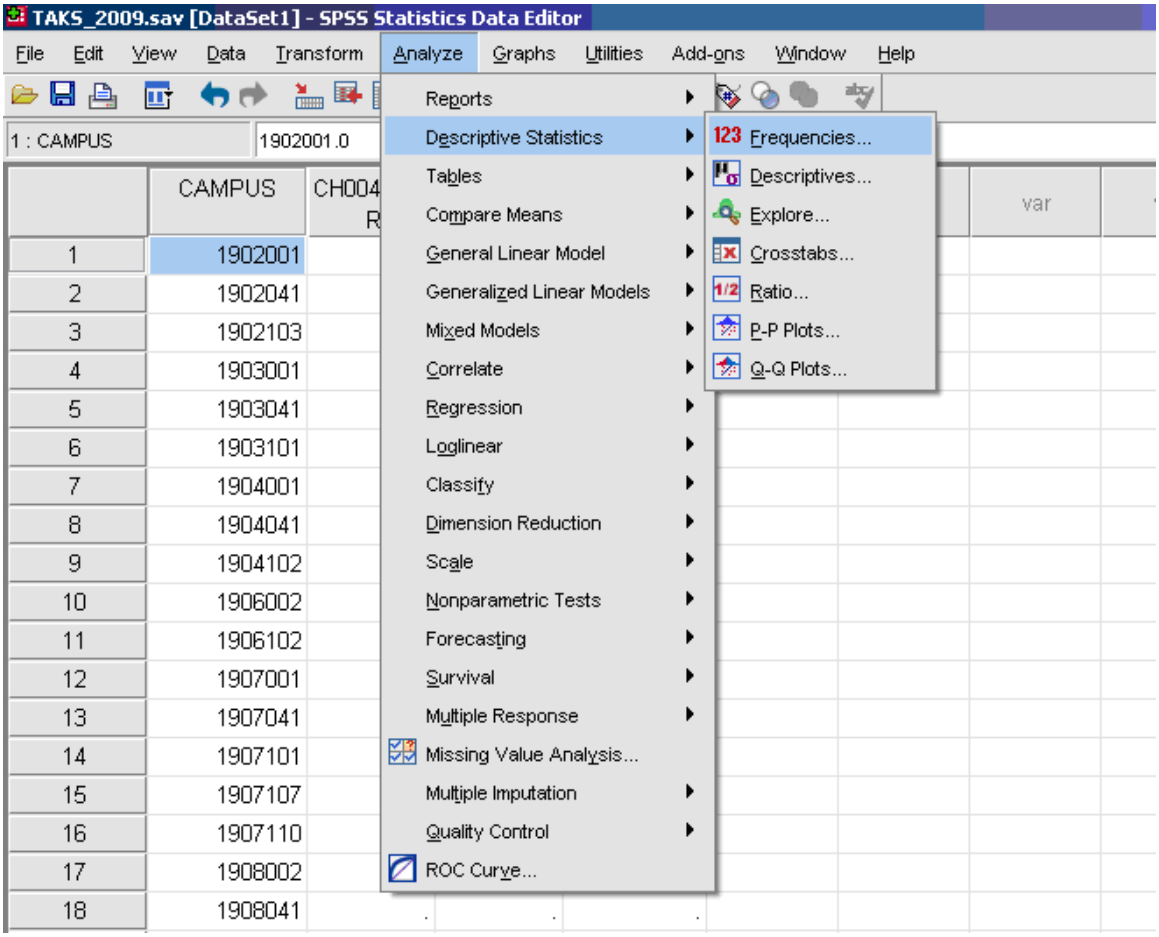
[5] http://www.writingandstatisticalhelp.com
[6] http://www.ncpeapublications.org
[7] http://ncpeapublications.org/about-elr.html
[8] http://cnx.org/content/col10606/latest/

8.2.1 Step One:

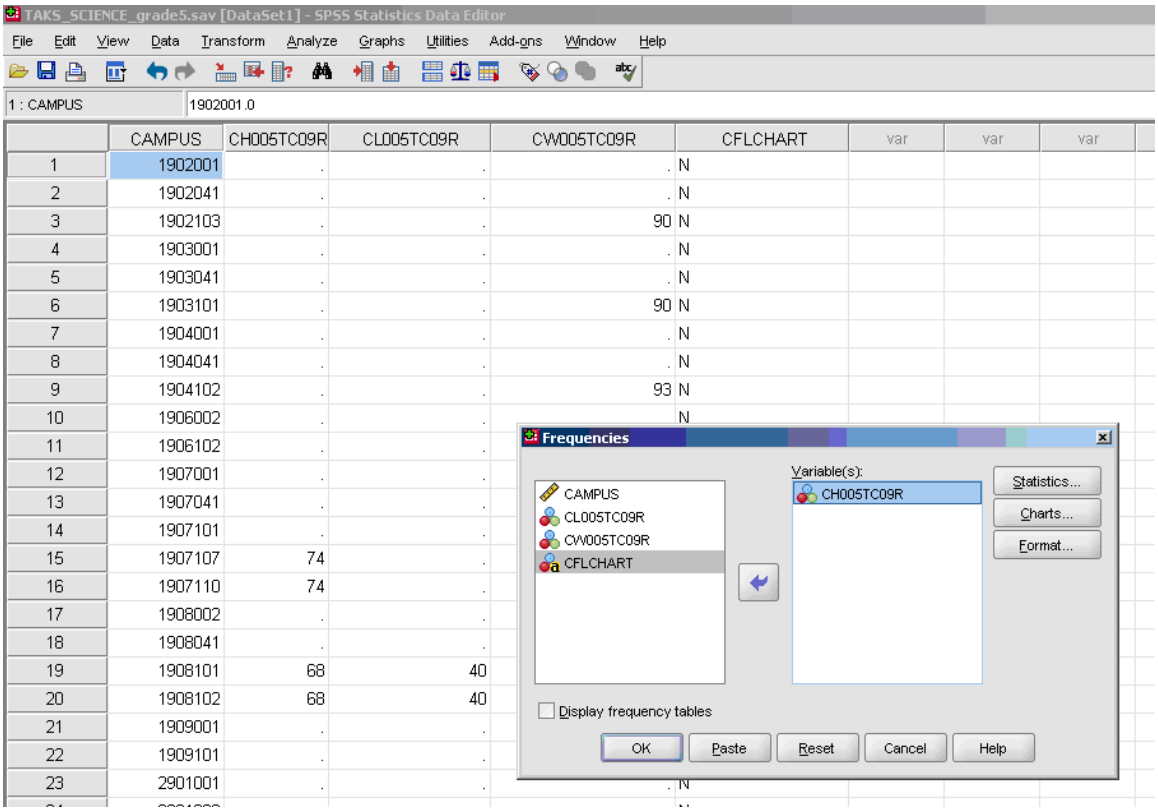
Compute Measures of Normality for the Dependent Variable
√ Analyze
* Descriptive Statistics
* Frequencies



[9]

√ Move over the dependent (outcome) variable

[9] http://cnx.org/content/m37333/latest/figure7.1.PNG/image



[10]

√ Statistics

* Skewness [Note. Skewness refers to the extent to which the data are normally distributed around the mean. Skewed data involve having either mostly high scores with a few low ones or having mostly low scores with a few high ones.] Readers are referred to the following sources for a more detailed definition of skewness: http://www.statistics.com/index.php?page=glossary&term_id=356 and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb

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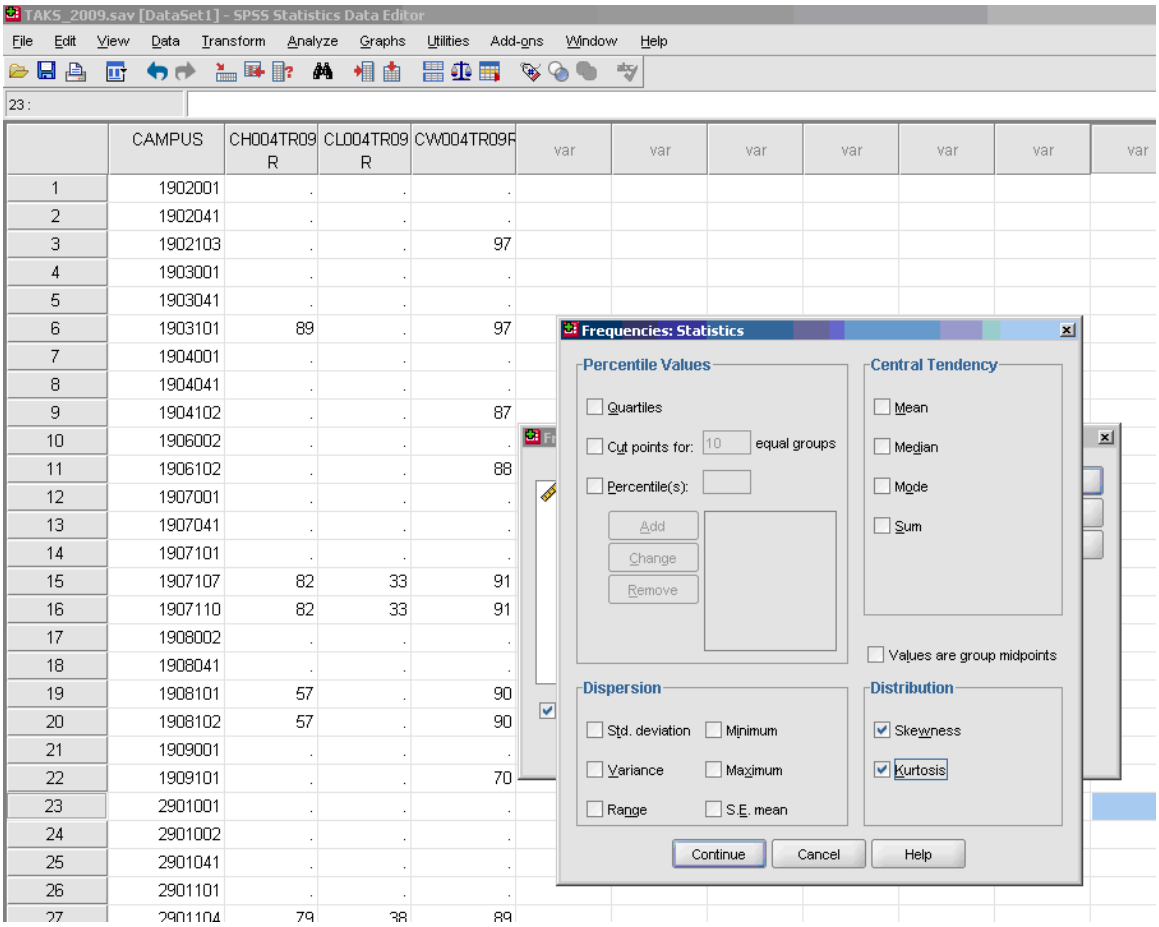
* Continue
* OK

[10] http://cnx.org/content/m37333/latest/figure7.2.PNG/image



[11]

8.2.2 Step Two:

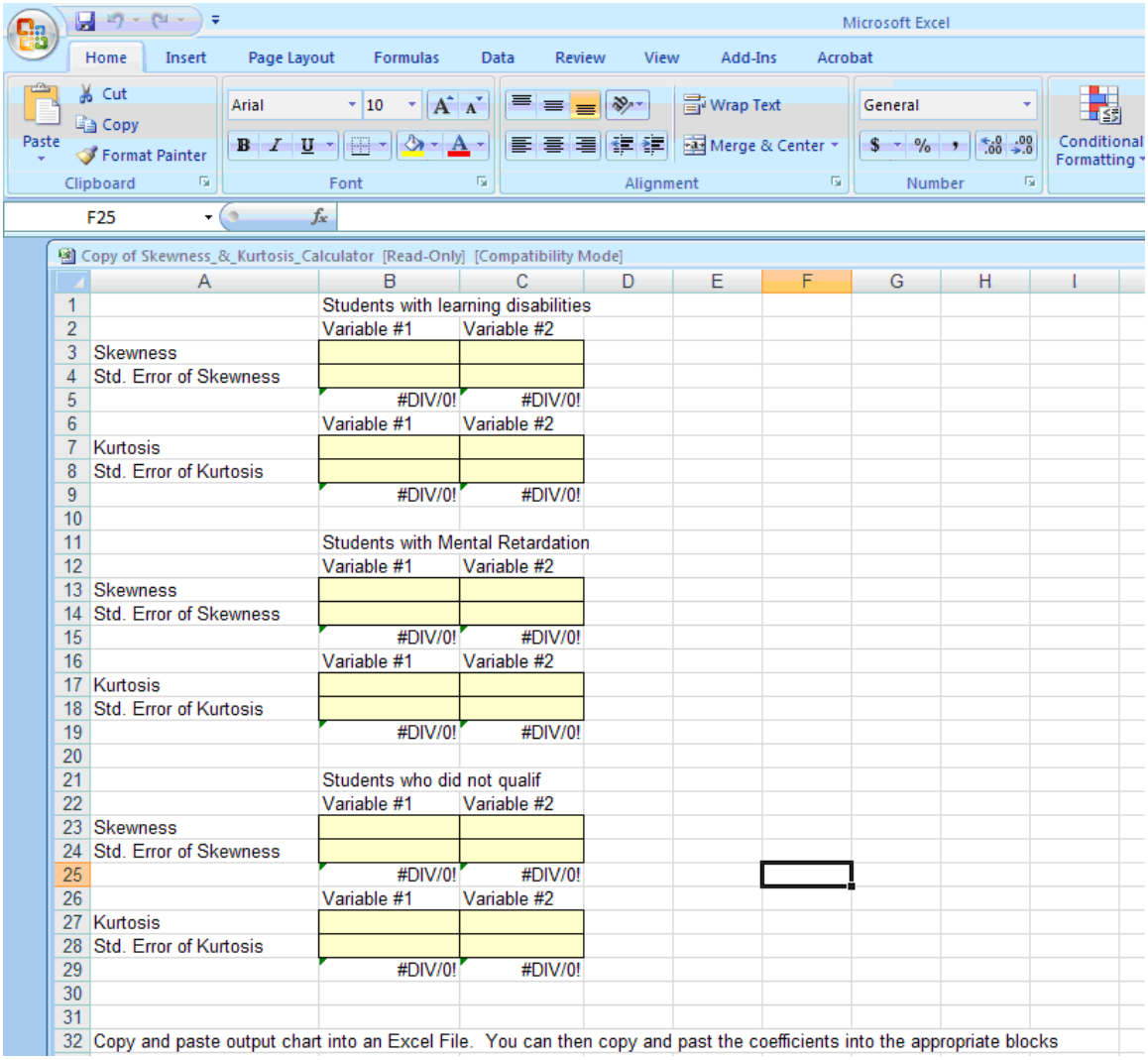
Check for Skewness and Kurtosis values falling within/without the parameters of normality (-3 to +3). Note that each variable below has its own skewness value and its own kurtosis value. Thus, a total of three standardized skewness coefficients and three standardized kurtosis coefficients can be calculated from information in the table below.

		CH005TC09R	CL005TC09R	CW005TC09R
N	Valid	3125	1805	1877
Missing	5197	6517	6445	
Skewness		-1.129	-.479	-2.197
Std. Error of Skewness		.044	.058	.056
Kurtosis		1.818	-.412	6.991
Std. Error of Kurtosis		.088	.115	.113

Table 8.1: Skewness and Kurtosis coefficients

[11] http://cnx.org/content/m37333/latest/figure7.3.PNG/image

Standard Coefficients Calculator
Copy variable #1 and #2 into the skewness and kurtosis calculator

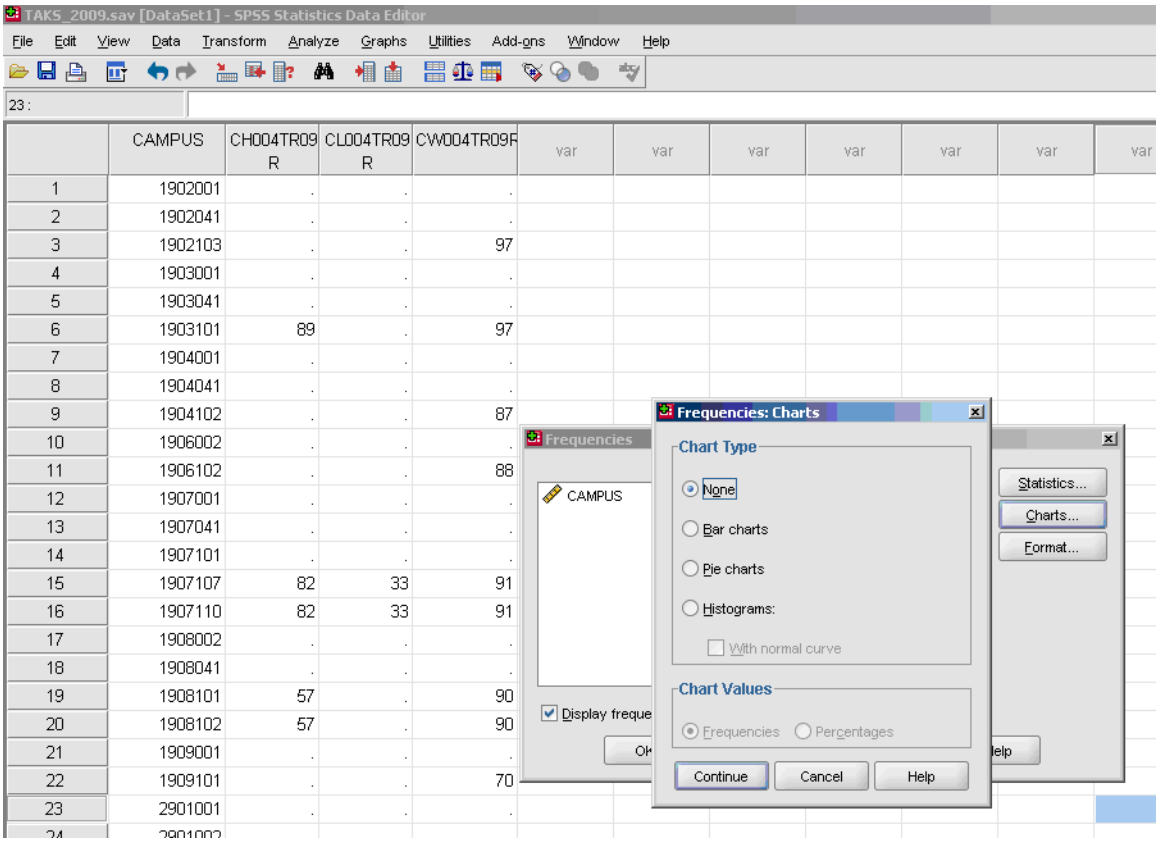


	A	B	C	D	E	F	G	H	I
1		Students with learning disabilities							
2		Variable #1	Variable #2						
3	Skewness								
4	Std. Error of Skewness								
5		#DIV/0!	#DIV/0!						
6		Variable #1	Variable #2						
7	Kurtosis								
8	Std. Error of Kurtosis								
9		#DIV/0!	#DIV/0!						
10									
11		Students with Mental Retardation							
12		Variable #1	Variable #2						
13	Skewness								
14	Std. Error of Skewness								
15		#DIV/0!	#DIV/0!						
16		Variable #1	Variable #2						
17	Kurtosis								
18	Std. Error of Kurtosis								
19		#DIV/0!	#DIV/0!						
20									
21		Students who did not qualif							
22		Variable #1	Variable #2						
23	Skewness								
24	Std. Error of Skewness								
25		#DIV/0!	#DIV/0!						
26		Variable #1	Variable #2						
27	Kurtosis								
28	Std. Error of Kurtosis								
29		#DIV/0!	#DIV/0!						
30									
31									
32	Copy and paste output chart into an Excel File. You can then copy and past the coefficients into the appropriate blocks								

[12]

√ Charts (these are calculated only if you wish to have visual depictions of skewness and of kurtosis-they are not required)
* Histogram∼ with normal curve (not required, optional)

[12] http://cnx.org/content/m37333/latest/figure7.4.PNG/image

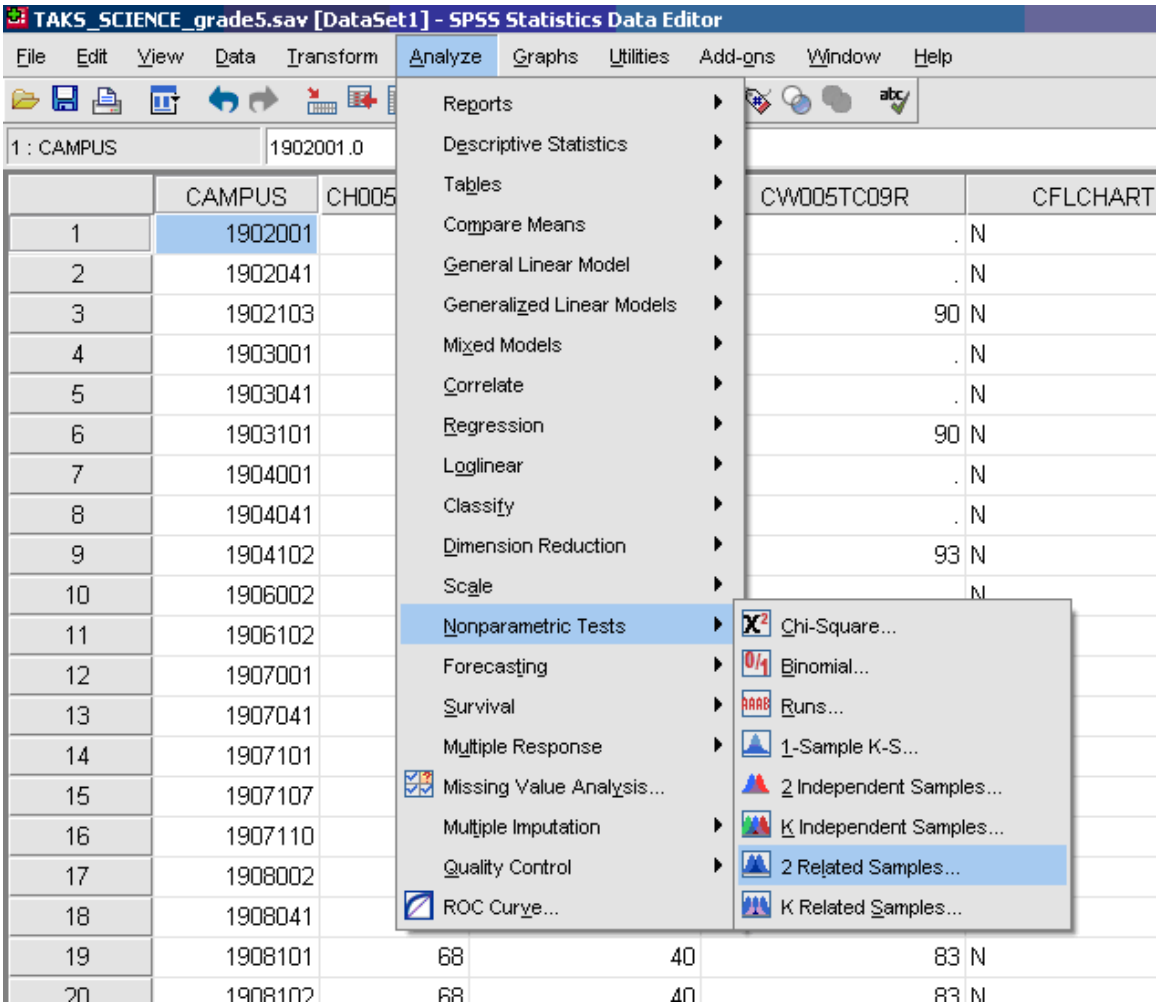


[13]

8.2.3 Step Three:

Calculate Nonparametric Paired Samples t -test on Data

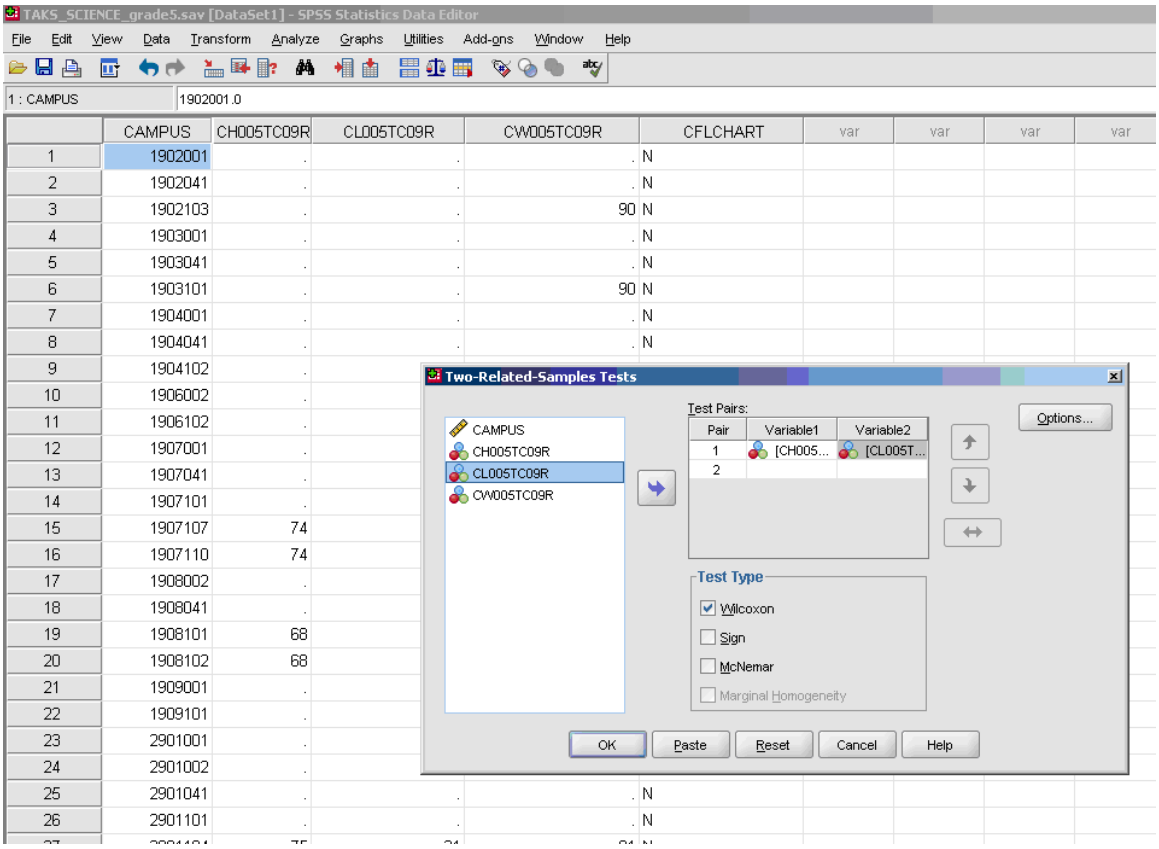
[13] http://cnx.org/content/m37333/latest/figure7.5.PNG/image



[14]

√ Click on one dependent variable
* Arrow to send over to Test Pairs, Variable 1
√ Click on second dependent variable
* Arrow to send over to Test Pairs, Variable 2
* OK

[14] http://cnx.org/content/m37333/latest/figure7.6.PNG/image



[15]

8.2.4 Step Four:

Check for Statistical Significance

Test Statistics[b]

	CL005TC09R
	CH005TC09R
Z	-34.829[a]
Asymp. Sig. (2-tailed)	.000

Table 8.2

a. Based on positive ranks.
b. Wilcoxon Signed Rank test

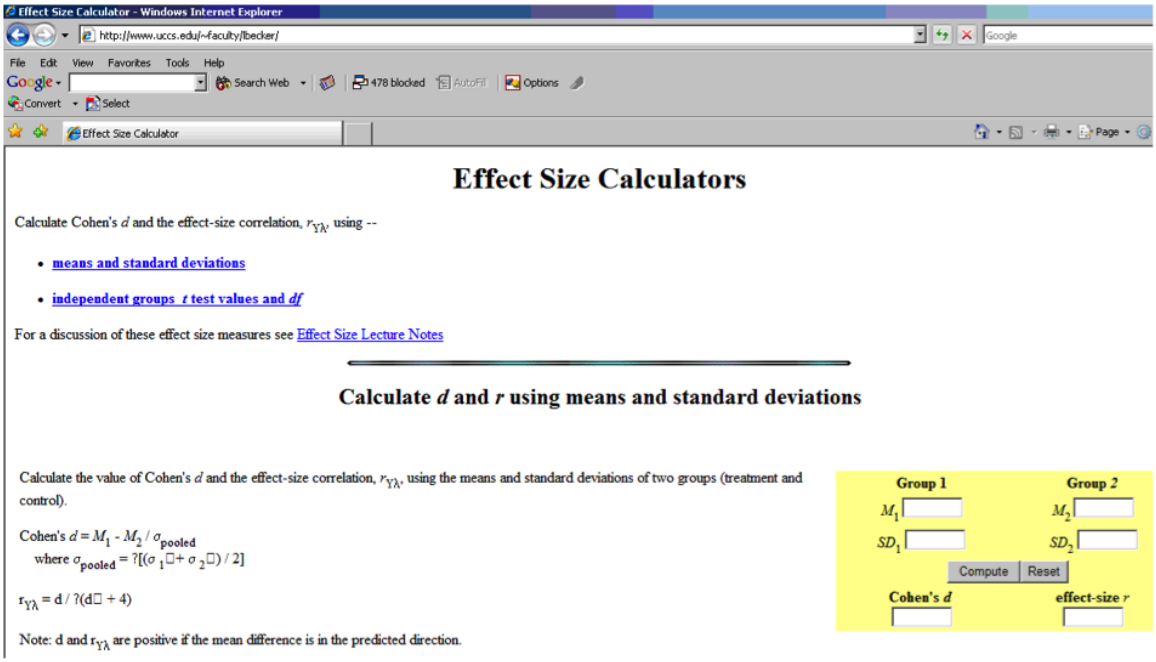
Numerical sentence is written as: z = -34.83, $p < .001$

[15] http://cnx.org/content/m37333/latest/figure7.7.PNG/image

8.2.5 Step Five

Check for Effect Size

* Use the web-based calculator for effect size using the following website:
Effect Size Calculators for Basic and Multivariate Statistical Procedures[16]



[17]

8.3 Writing Up Your Statistics

So, how do you "write up" your Research Questions and your Results? Schuler W. Huck (2000) in his seminal book entitled, *Reading Statistics and Research*, points to the importance of your audience understanding and making sense of your research in written form. Huck further states:

8.3.1

This book is designed to help people *decipher* what researchers are trying to communicate in the written or oral summaries of their investigations. Here, the goal is simply to distill meaning from the words, symbols, tables, and figures included in the research report. To be competent in this arena, one must not only be able to decipher what's presented but also to "fill in the holes"; this is the case because researchers typically assume that those receiving the research report are familiar with unmentioned details of the research process and statistical treatment of data.

Researchers and Professors John Slate and Ana Rojas-LeBouef understand this critical issue, so often neglected or not addressed by other authors and researchers. They point to the importance of doctoral students "writing up their statistics" in a way that others can understand your reporting and as importantly, interpret the meaning of your significant findings and implications for the preparation and practice of educational leadership. Slate and LeBouef provide you with a model for "writing up your nonparametric paired samples t-test."

Click here to view: *Writing Up Your Nonparametric Paired Samples t-test Statistics* [18]

[16] http://www.uccs.edu/~faculty/lbecker/
[17] http://cnx.org/content/m37333/latest/figure7.8.png/image
[18] http://cnx.org/content/col11299/latest/

8.4 References

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erbaum

Hyperstats Online Statistics Textbook. (n.d.) Retrieved from http://davidmlane.com/hyperstat/[19]

Kurtosis. (n.d.). Definition. Retrieved from http://www.statistics.com/index.php?page=glossary&term_id=326[20]

Kurtosis. (n.d.). *Definition of normality*. Retrieved from http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb[21]

Onwuegbuzie, A. J., & Daniel, L. G. (2002). Uses and misuses of the correlation coefficient. *Research in the Schools, 9*(1), 73-90.

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StatSoft, Inc. (2011). *Electronic statistics textbook*. Tulsa, OK: StatSoft. WEB: http://www.statsoft.com/textbook/[24]

[19] http://davidmlane.com/hyperstat/
[20] http://www.statistics.com/index.php?page=glossary&term_id=326
[21] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[22] http://www.statistics.com/index.php?page=glossary&term_id=356
[23] http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb
[24] http://www.statsoft.com/textbook/

Chapter 9

Conducting a Parametric One-Way Analysis of Variance[1]

NOTE: This chapter has been peer-reviewed, accepted, and endorsed by the National Council of Professors of Educational Administration (NCPEA) as a significant contribution to the scholarship and practice of education administration. Formatted and edited in Connexions by Theodore Creighton and Brad Bizzell, Virginia Tech, Janet Tareilo, Stephen F. Austin State University, and Thomas Kersten, Roosevelt University.

9.1

This chapter is part of a larger Collection (Book) and is available at: *Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts* [2]

NOTE: Slate and LeBouef have written a "companion book" which is available at: *Preparing and Presenting Your Statistical Findings: Model Write Ups* [3]

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John R. Slate is a Professor at Sam Houston State University where he teaches Basic and Advanced Statistics courses, as well as professional writing, to doctoral students in Educational Leadership and Counseling. His research interests lie in the use of educational databases, both state and national, to reform school practices. To date, he has chaired and/or served over 100 doctoral student dissertation committees. Recently, Dr. Slate created a website Writing and Statistical Help[4] to assist students and faculty with both statistical assistance and in editing/writing their dissertations/theses and manuscripts.

[1] This content is available online at <http://cnx.org/content/m37334/1.4/>.
[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[3] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[4] http://www.writingandstatisticalhelp.com

Ana Rojas-LeBouef is a Literacy Specialist at the Reading Center at Sam Houston State University where she teaches developmental reading courses. She recently completed her doctoral degree in Reading, where she conducted a 16-year analysis of Texas statewide data regarding the achievement gap. Her research interests lie in examining the inequities in achievement among ethnic groups. Dr. Rojas-LeBouef also assists students and faculty in their writing and statistical needs on the website Writing and Statistical Help.[5]

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Thomas Kersten is a Professor at Roosevelt University in Chicago. Dr. Kersten is widely published and an experienced editor and is the author of Taking the Mystery Out of Illinois School Finance[8] , a Connexions Print on Demand publication. He is also serving as Editor in Residence for this book by Slate and LeBouef.

9.2 Conducting a Parametric One-Way Analysis of Variance

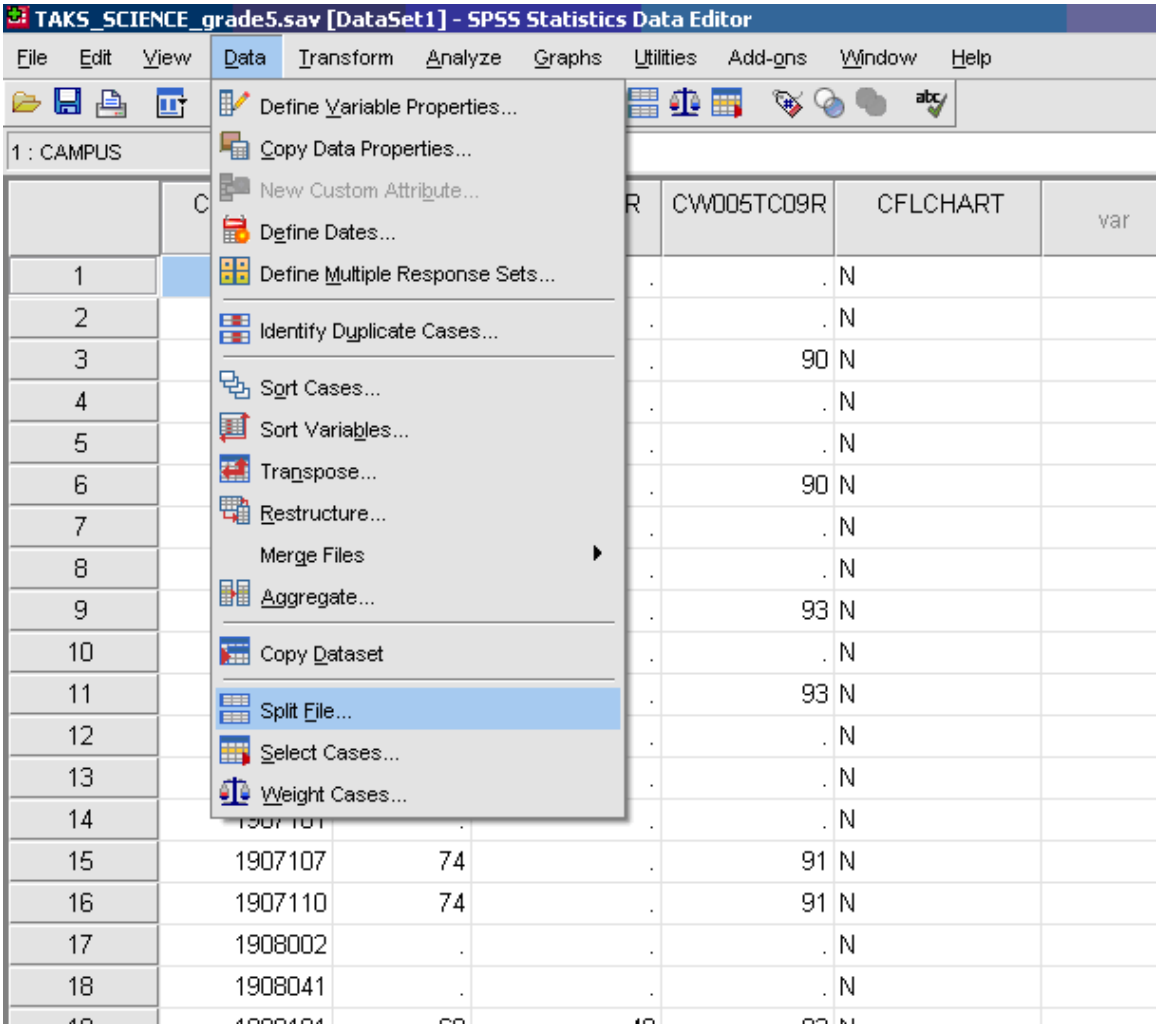
In this set of steps, readers will calculate either a parametric or a nonparametric statistical analysis, depending on whether the data for the dependent variable reflect a normal distribution. A parametric statistical procedure requires that its data be reflective of a normal curve whereas no such assumption is made in the use of a nonparametric procedure. Of the two types of statistical analyses, the parametric procedure is the more powerful one in ascertaining whether or not a statistically significant difference, in this case, exists. As such, parametric procedures are preferred over nonparametric procedures. When data are not normally distributed, however, parametric analyses may provide misleading and inaccurate results. According, nonparametric analyses should be used in cases where data are not reflective of a normal curve. In this set of steps, readers are provided with information on how to make the determination of normally or nonnormally distributed data. For detailed information regarding the assumptions underlying parametric and nonparametric procedures, readers are referred to the Hyperstats Online Statistics Textbook at http://davidmlane.com/hyperstat/ or to the Electronic Statistics Textbook (2011) at http://www.statsoft.com/textbook/

For this parametric analysis of variance procedure to be appropriately used, at least half of the standardized skewness coefficients and the standardized kurtosis coefficients must be within the normal range (+/-3, Onwuegbuzie & Daniel, 2002). Research questions for which parametric analysis of variance procedures are appropriate involve asking for differences in a dependent variable by group membership (i.e., more than two groups may be present). The research question, "What is the difference in science achievement among elementary school students as a function of ethnic membership?" could be answered through use of an analysis of variance procedure.

[5] http://www.writingandstatisticalhelp.com
[6] http://www.ncpeapublications.org
[7] http://ncpeapublications.org/about-elr.html
[8] http://cnx.org/content/col10606/latest/

9.2.1 Step One:

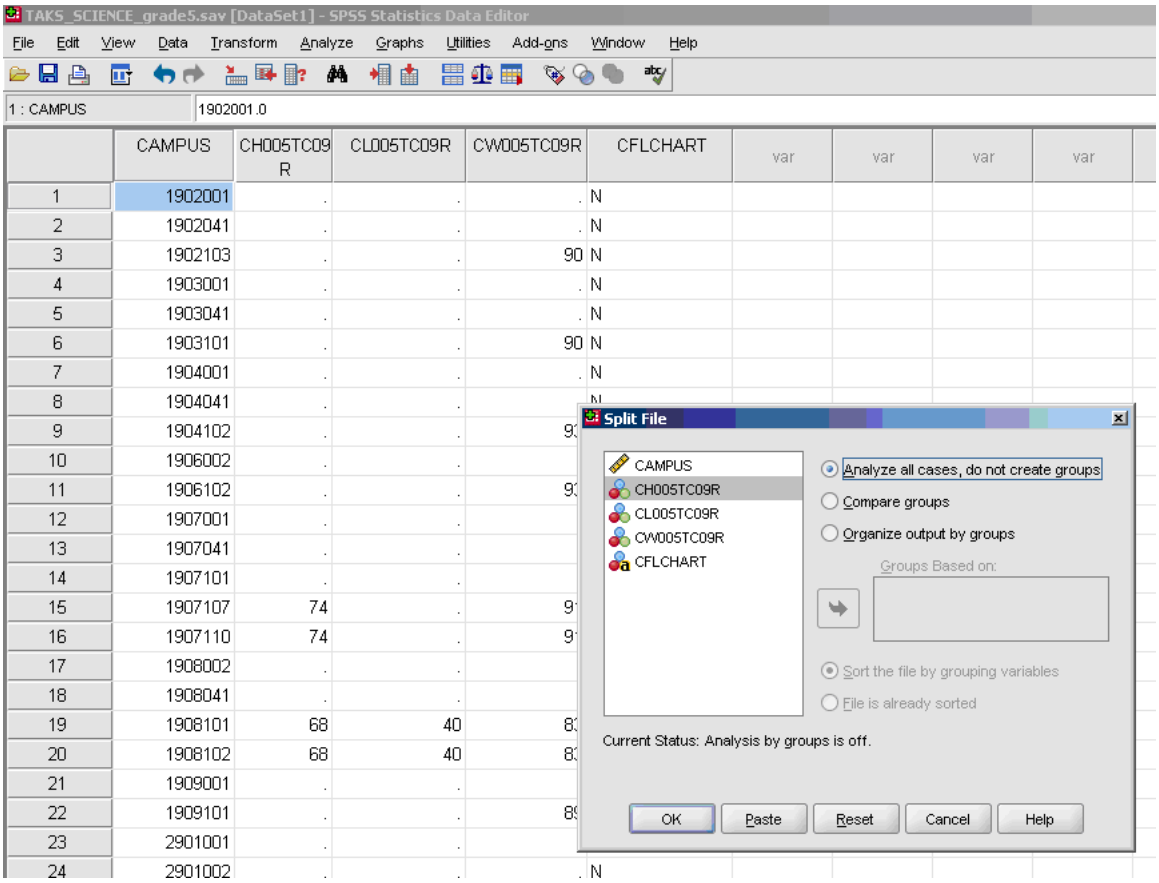
Check for Skewness and Kurtosis values falling within/without the parameters of normality (-3 to +3)
√ Split your file on the basis on your independent variable/fixed factor/grouping variable



[9]

After you do this, your screen should resemble the following:

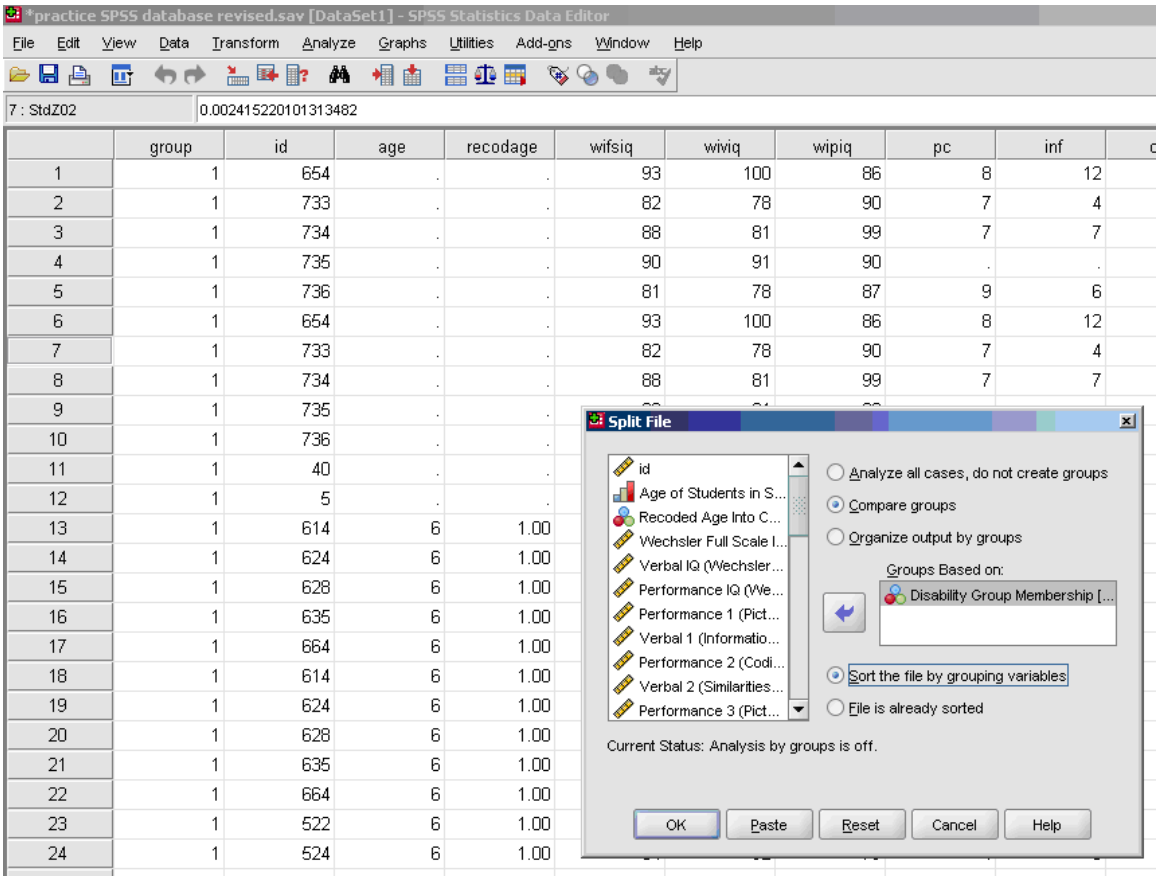
[9] http://cnx.org/content/m37334/latest/figure8.1.PNG/image



[10]

Your screen will show that all cases are going to be analyzed and a "do not create groups". You will need to click the compare groups and move the independent variable over to the "Group Based on". For most ANOVA procedures, your independent or grouping variable will have more than two groups.

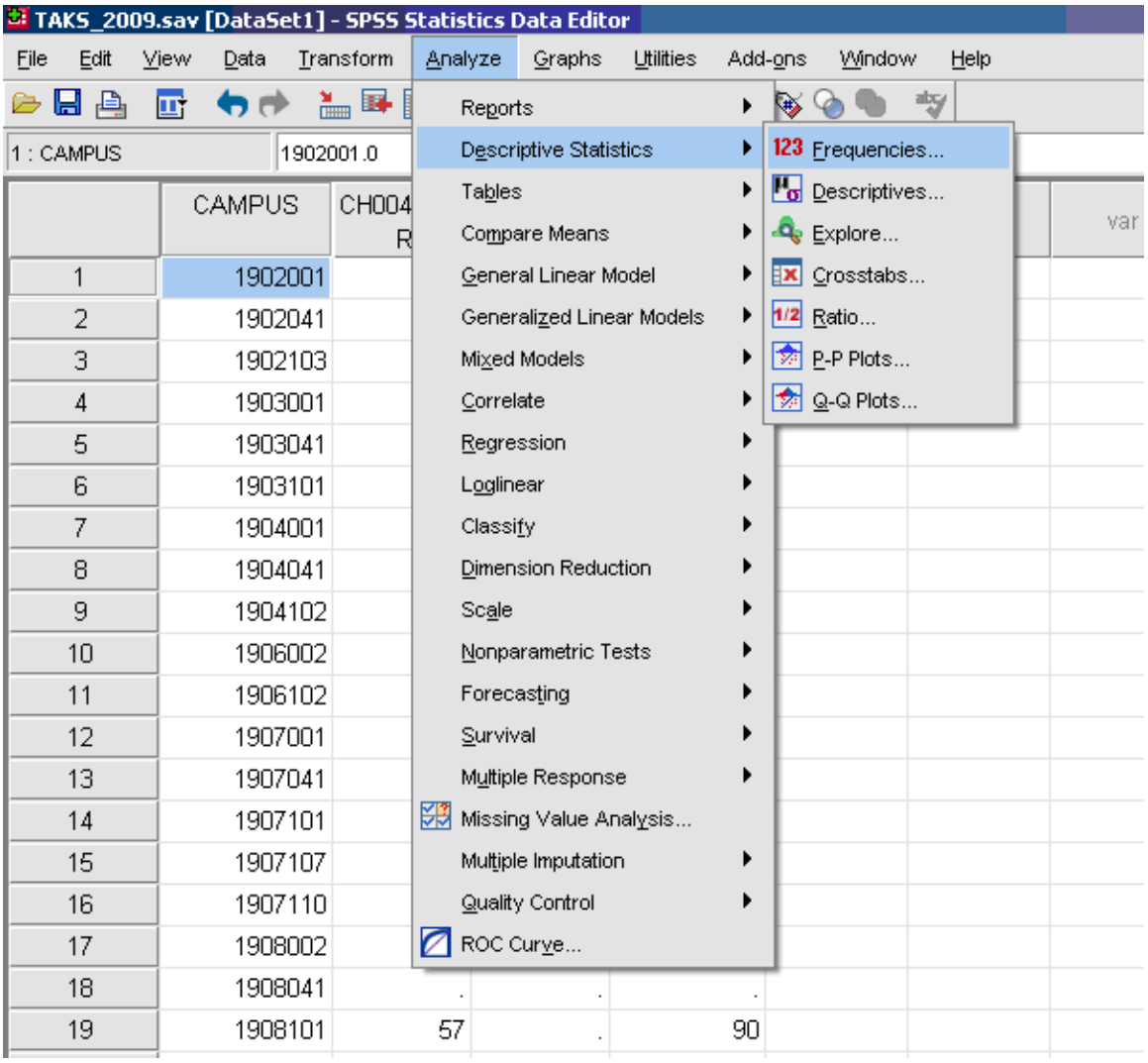
[10] http://cnx.org/content/m37334/latest/figure8.2.1.PNG/image



[11]

√ Analyze
* Descriptive Statistics
* Frequencies

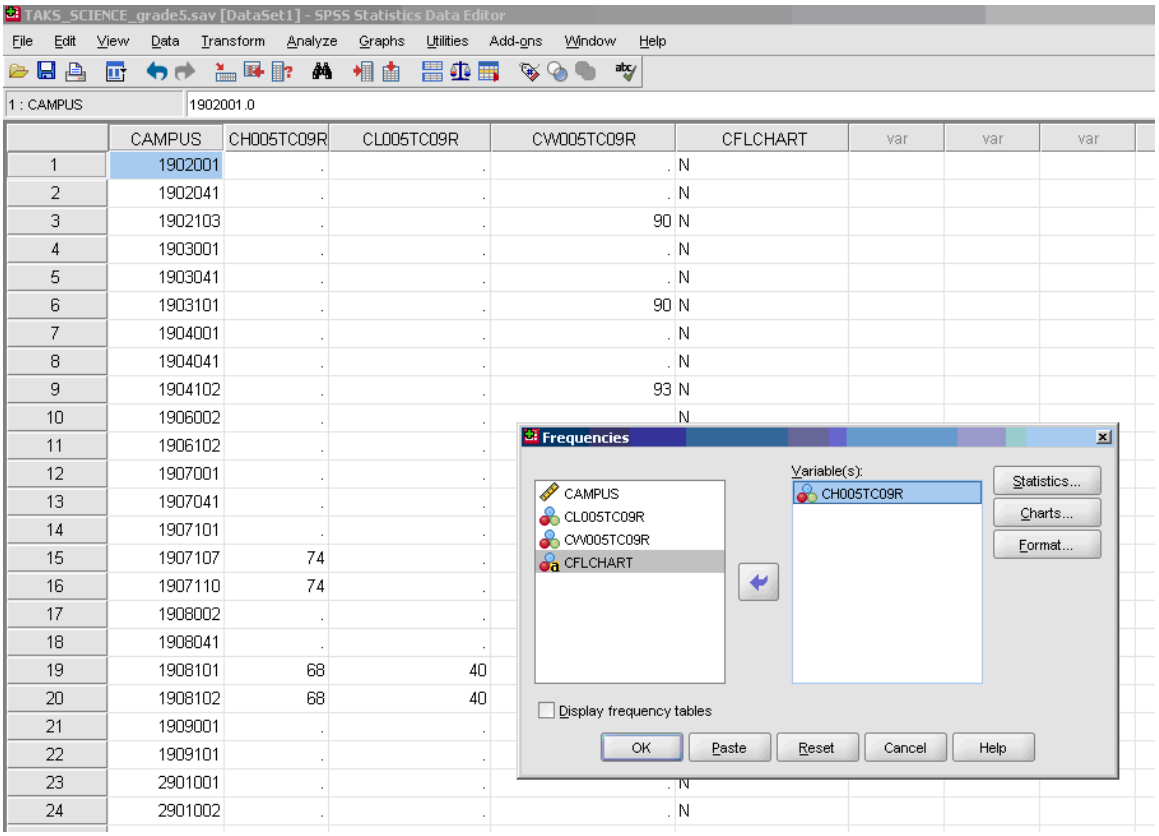
[11] http://cnx.org/content/m37334/latest/figure8.3.PNG/image



[12]

√ Move over the dependent (outcome) variable

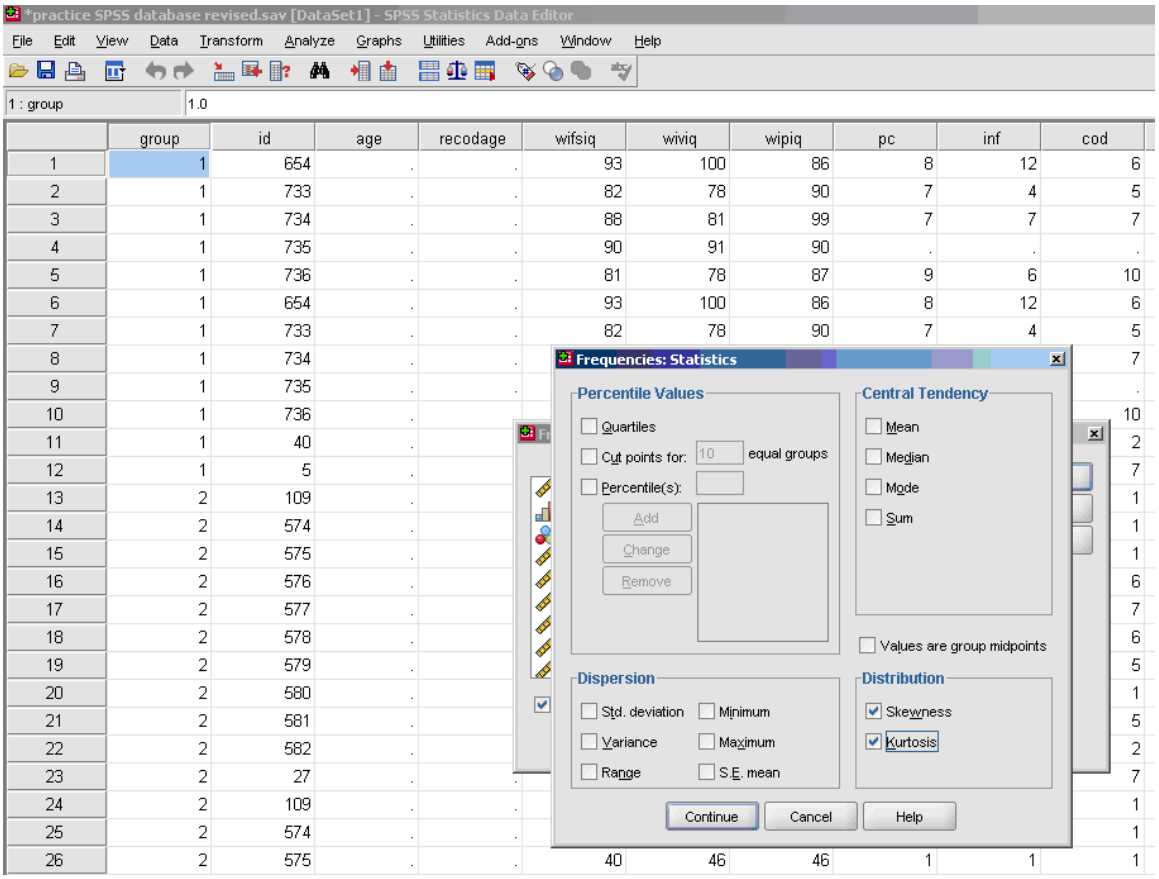
[12] http://cnx.org/content/m37334/latest/figure8.4.PNG/image



[13]

√ Click on Statistics
Your screen will now look like this

[13] http://cnx.org/content/m37334/latest/figure8.5.PNG/image



	group	id	age	recodage	wifsiq	wiviq	wipiq	pc	inf	cod	
1	1	654	.	.	93	100	86	8	12	6	
2	1	733	.	.	82	78	90	7	4	5	
3	1	734	.	.	88	81	99	7	7	7	
4	1	735	.	.	90	91	90	.	.	.	
5	1	736	.	.	81	78	87	9	6	10	
6	1	654	.	.	93	100	86	8	12	6	
7	1	733	.	.	82	78	90	7	4	5	
8	1	734	.	.						7	
9	1	735	.	.						.	
10	1	736	.	.						10	
11	1	40	.	.						2	
12	1	5	.	.						7	
13	2	109	.	.						1	
14	2	574	.	.						1	
15	2	575	.	.						1	
16	2	576	.	.						6	
17	2	577	.	.						7	
18	2	578	.	.						6	
19	2	579	.	.						5	
20	2	580	.	.						1	
21	2	581	.	.						5	
22	2	582	.	.						2	
23	2	27	.	.						7	
24	2	109	.	.						1	
25	2	574	.	.						1	
26	2	575	.	.	40	46	46	1	1	1	14

* Skewness [Note. Skewness refers to the extent to which the data are normally distributed around the mean. Skewed data involve having either mostly high scores with a few low ones or having mostly low scores with a few high ones.] Readers are referred to the following sources for a more detailed definition of skewness: http://www.statistics.com/index.php?page=glossary&term_id=356 and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb

To standardize the skewness value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the skewness value from the SPSS output and divide it by the Std. error of skewness. If the resulting calculation is within -3 to +3, then the skewness of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside of this +/-3 range, the dataset is not normally distributed.

* Kurtosis [Note. Kurtosis also refers to the extent to which the data are normally distributed around the mean. This time, the data are piled up higher than normal around the mean or piled up higher than normal at the ends of the distribution.] Readers are referred to the following sources for a more detailed definition of kurtosis: http://www.statistics.com/index.php?page=glossary& term_id=326 and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb

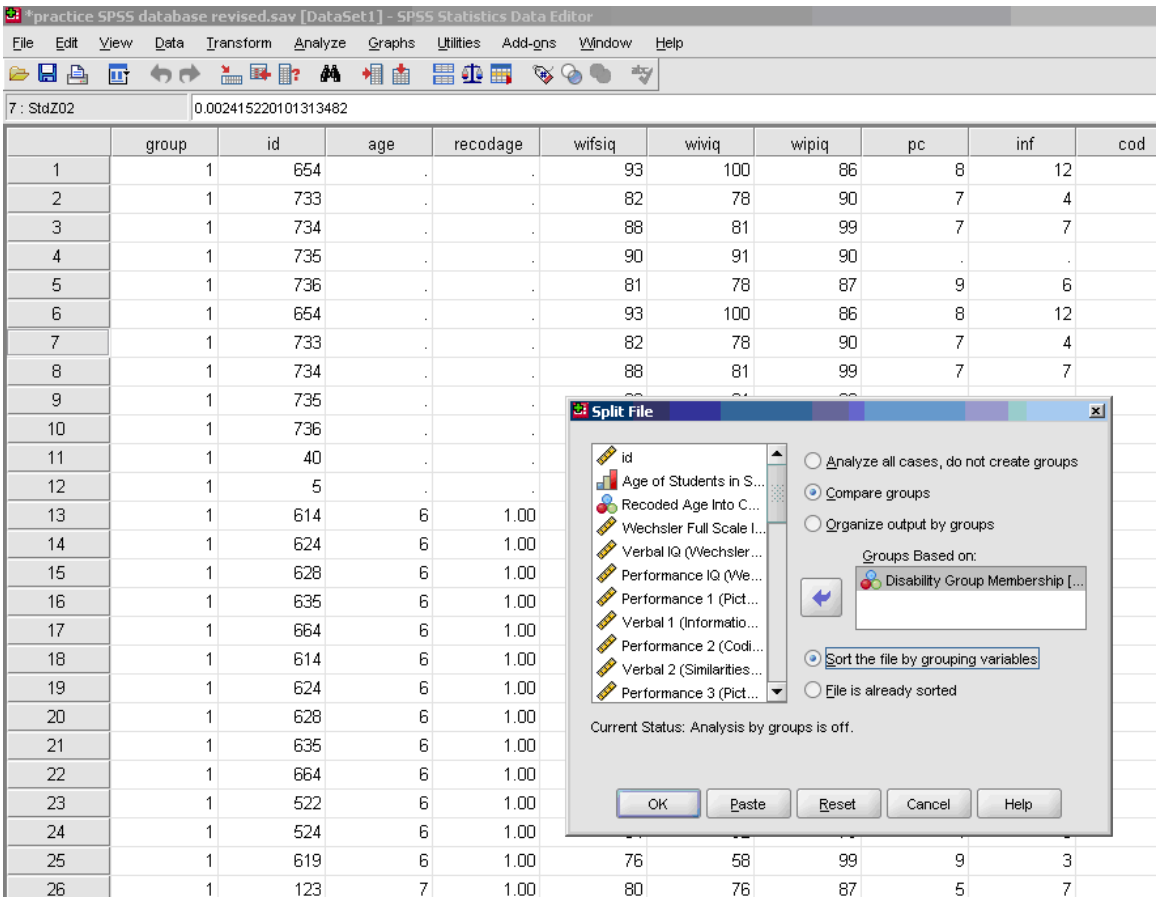
To standardize the kurtosis value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the kurtosis value from the SPSS output and divide it by the Std. error of kurtosis. If the resulting calculation is within -3 to +3, then the kurtosis of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside of this +/-3 range, the dataset is not normally distributed.

* Continue
* OK

[14] http://cnx.org/content/m37334/latest/figure8.6.PNG/image

Note: Before you continue to another application you must "UNSPLIT" the files before moving on to other steps:

√ Data
√ Split Files
√ Analyze all cases, do not create groups
√ OK



Check for Skewness and Kurtosis values falling within/without the parameters of normality (-3 to +3). Note that each variable below has its own skewness value and its own kurtosis value. Thus, a total of three standardized skewness coefficients and three standardized kurtosis coefficients can be calculated from information in the table below.

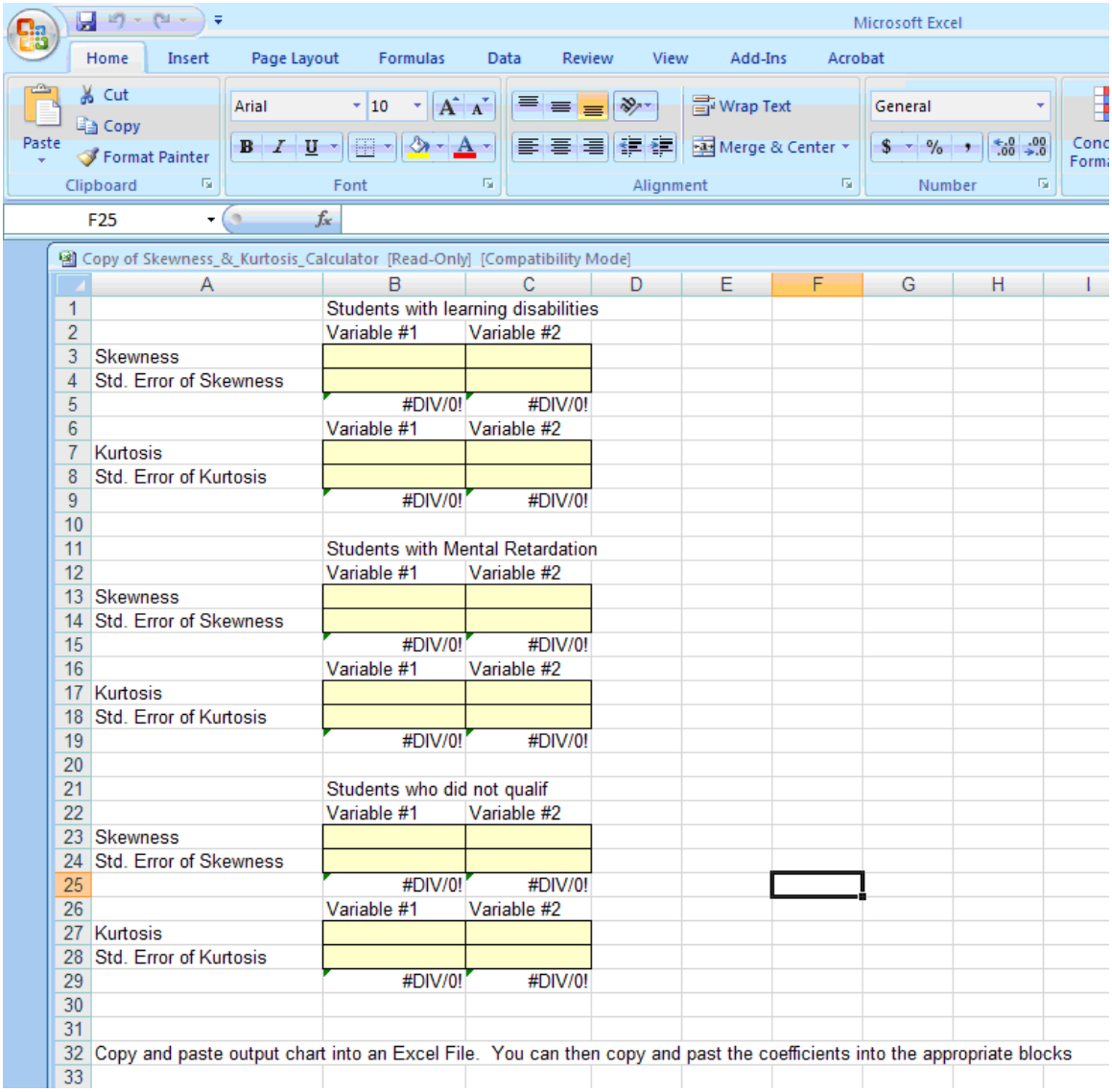
[15] http://cnx.org/content/m37334/latest/figure8.7.PNG/image

Skewness and Kurtosis Coefficients

	CH005TC09R	CL005TC09R	CW005TC09R
N Valid	3125	1805	1877
Missing	5197	6517	6445
Skewness	**-1.129**	**-.479**	**-2.197**
Std. Error of Skewness	**.044**	**.058**	**.056**
Kurtosis	**1.818**	**-.42**	**6.991**
Std. Error of Kurtosis	**.088**	**.115**	**.113**

Table 9.1

Copy skewness and kurtosis information into the skewness and kurtosis calculator



[16]

9.2.2 Step Two

Compute Descriptive Statistics on the Dependent Variable

* Do so via the ANOVA procedure
* Note. Do not use the ANOVA statistical significance information provided in the output. Use only the *M*s, *SD*s, and *n*s.
* **The screen shot will occur in the next step** (Mean and standard deviation)

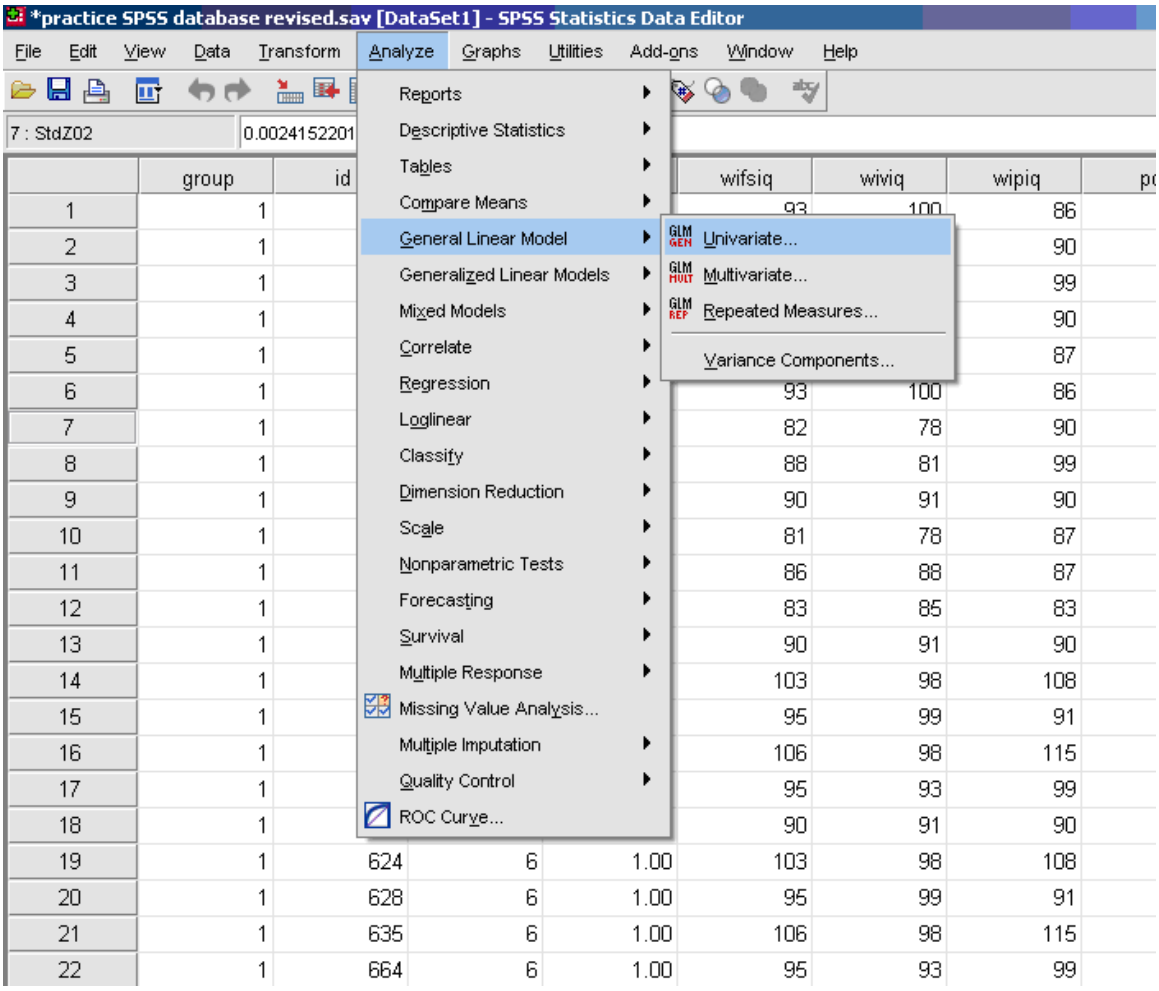
9.2.3 Step Three

Conduct Analysis of Variance

√ Analyze
√ General Linear Model

[16] http://cnx.org/content/m37334/latest/calc.PNG/image

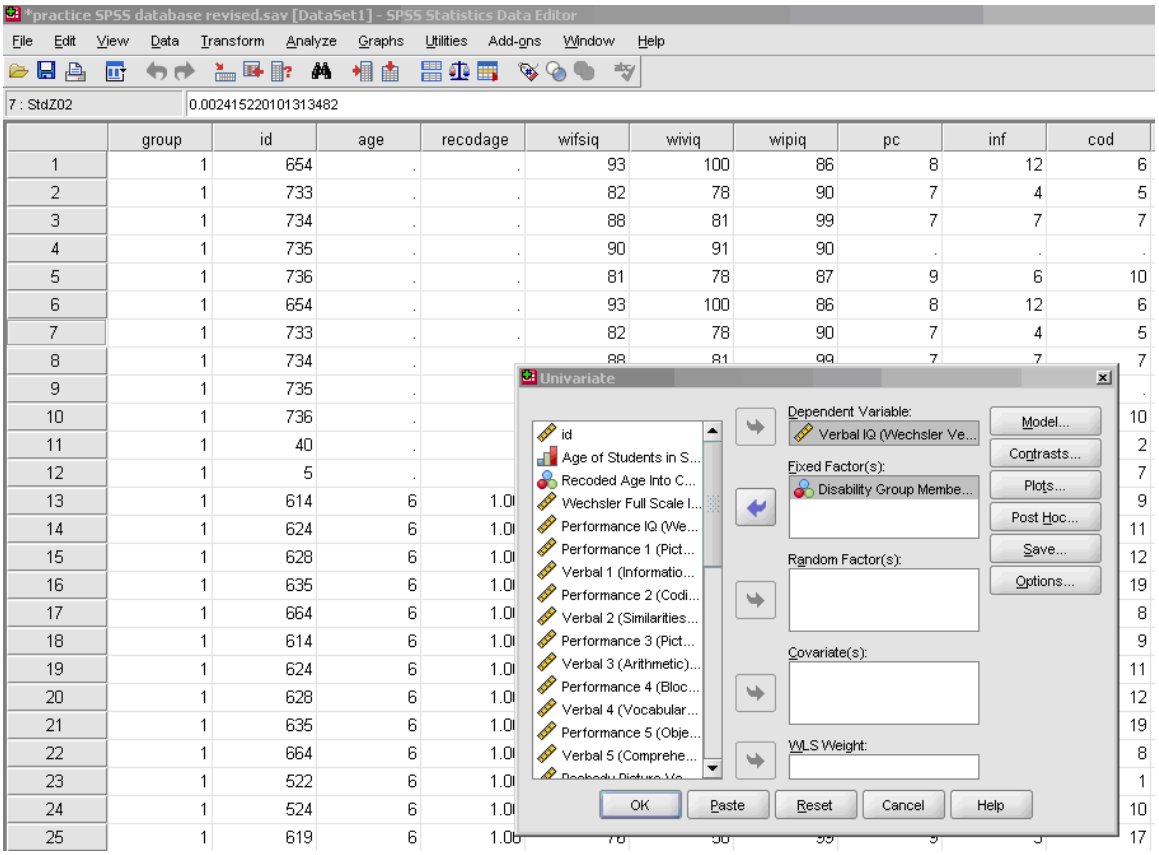
√ Univariate



[17]

√ Dependent variable is sent over to the top box, titled dependent variable
√ Grouping Variable is sent over to the fixed factor box

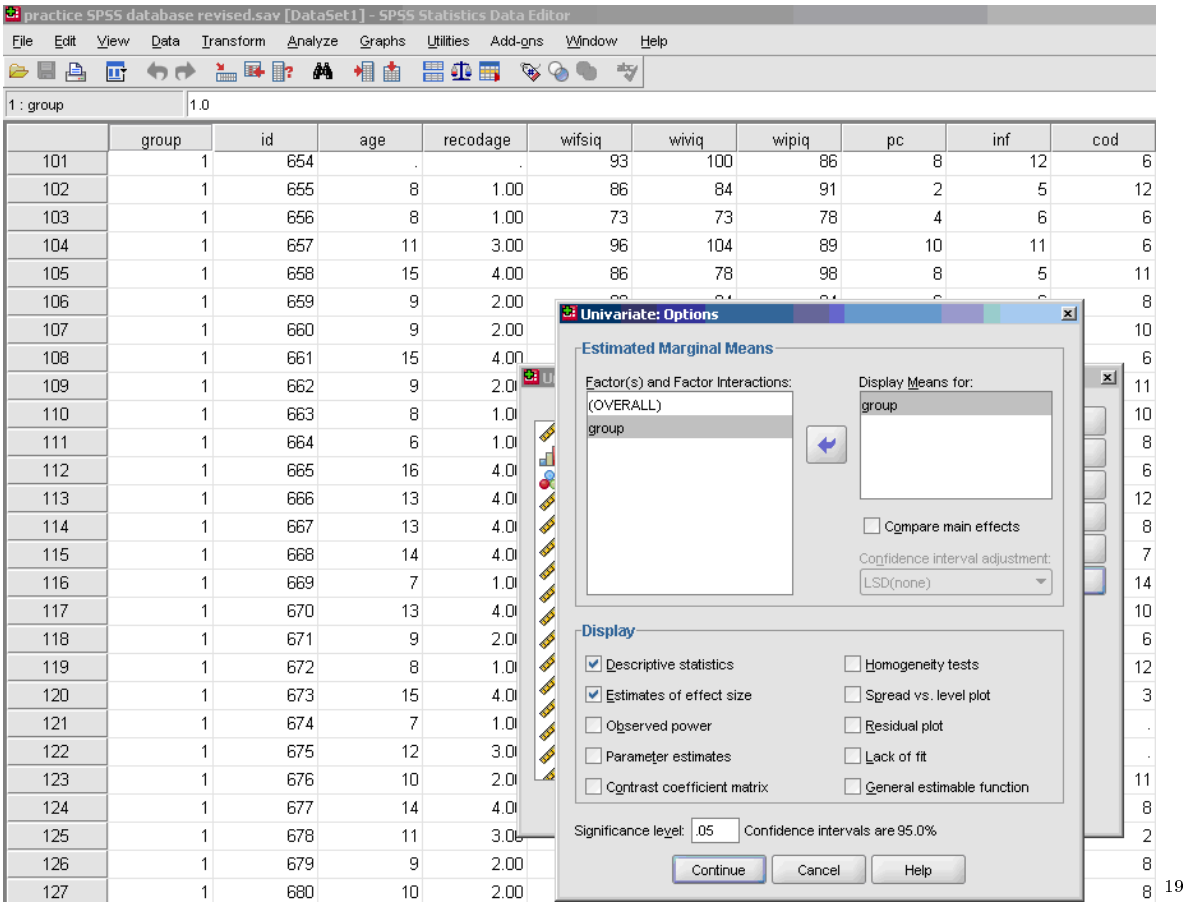
[17] http://cnx.org/content/m37334/latest/figure8.8.PNG/image



[18]

√ Options
√ Descriptive Statistics
√ Estimate of effect size
√ Continue

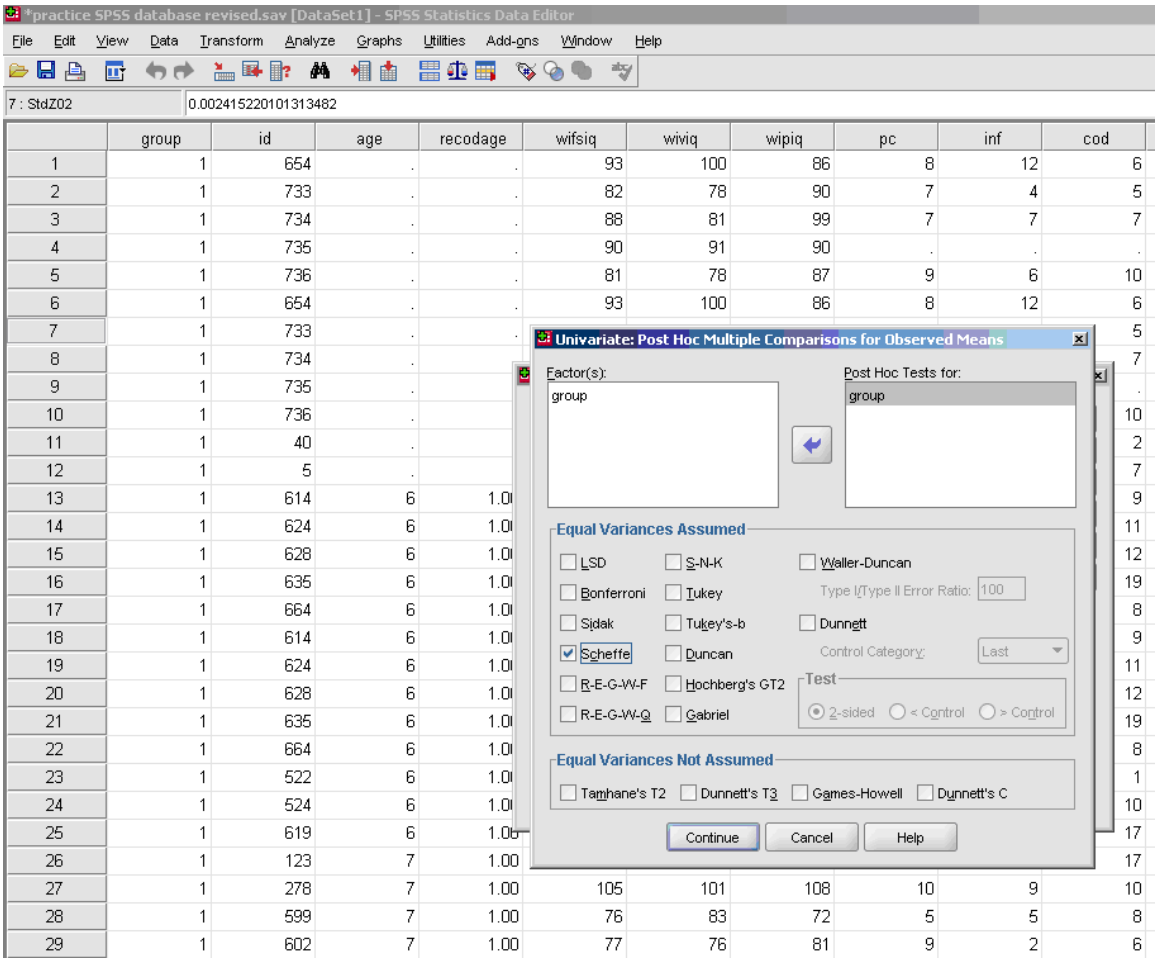
[18] http://cnx.org/content/m37334/latest/figure8.9.PNG/image



[19]

√ Post Hoc
√ Scheffé
√ Click on variables on which you want the Post Hoc Tests
√ Continue
√ OK

[19] http://cnx.org/content/m37334/latest/overall.PNG/image



9.2.4 Step Four

Check for Statistical Significance

1. Go to the ANOVA table and look at the far right column labeled Sig to check for statistical significance.
2. If you have any value less than .05 then you have statistical significance. Remember to replace the third zero with a 1, if the sig value is .000 (i.e., if the sig value reads as .000, replace the third 0, so it reads as .001).
3. Numerical Sentence = $F(df$ between, df within$)_{sp}=_{sp}F$ value,$_{sp}p_{sp}<_{sp}.001$.
4. The outcome of the ANOVA, F (2,1179) = 503.22, p = .001, was . . . .

Dependent Variable: Verbal IQ (Wechsler Verbal Intelligence 3)

Tests Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared

continued on next page

[20] http://cnx.org/content/m37334/latest/figure8.11.PNG/image

Corrected	101503.093[a]	2	50751.547	503.219	.000	.461
Model						
Intercept	6366052.170	1	6366052.170	63121.595	.000	.982
group	**101503.093**	**2**	**50751.547**	**503.219**	**.000**	**.461**
Error	118906.620	**1179**	100.854			
Total	7405615.000	1182				
Corrected Total	220409.713	1181				

Table 9.2

a. R Squared = .461 (Adjusted R Square = .460)

9.2.5 Step Five

1. Partial Eta^2 is the effect size n^2
2. Cohen (1988)
.01 - .059 = small effect size
.06 - .139 = moderate effect size
.14 and above = large effect size
Note. n^2 cannot be greater than 1.00. Therefore, a 0 should not be placed in front of the decimal point.

9.2.6 Step Six:

Narrative and Interpretation
1. F value
2. degrees of freedom for groups and for participants
3. p value
4. Post hoc results
5. M, SD, and n for each group (in a table)

9.3 Writing Up Your Statistics

So, how do you "write up" your Research Questions and your Results? Schuler W. Huck (2000) in his seminal book entitled, *Reading Statistics and Research,* points to the importance of your audience understanding and making sense of your research in written form. Huck further states:

9.3.1

This book is designed to help people *decipher* what researchers are trying to communicate in the written or oral summaries of their investigations. Here, the goal is simply to distill meaning from the words, symbols, tables, and figures included in the research report. To be competent in this arena, one must not only be able to decipher what's presented but also to "fill in the holes"; this is the case because researchers typically assume that those receiving the research report are familiar with unmentioned details of the research process and statistical treatment of data.

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interpret the meaning of your significant findings and implications for the preparation and practice of educational leadership. Slate and LeBouef provide you with a model for "writing up your parametric ANOVA statistics."

Click here to view: *Writing Up Your Parametric One Way ANOVA Statistics* [21]

9.4 References

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erbaum

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[27] http://www.statsoft.com/textbook/

Chapter 10

Conducting a Nonparametric One-Way Analysis of Variance[1]

NOTE: This chapter has been peer-reviewed, accepted, and endorsed by the National Council of Professors of Educational Administration (NCPEA) as a significant contribution to the scholarship and practice of education administration. Formatted and edited in Connexions by Theodore Creighton and Brad Bizzell, Virginia Tech, Janet Tareilo, Stephen F. Austin State University, and Thomas Kersten, Roosevelt University.

10.1

This chapter is part of a larger Collection (Book) and is available at: *Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts* [2]

NOTE: Slate and LeBouef have written a "companion book" which is available at: *Preparing and Presenting Your Statistical Findings: Model Write Ups* [3]

Authors Information

John R. Slate is a Professor at Sam Houston State University where he teaches Basic and Advanced Statistics courses, as well as professional writing, to doctoral students in Educational Leadership and Counseling. His research interests lie in the use of educational databases, both state and national, to reform school practices. To date, he has chaired and/or served over 100 doctoral student dissertation committees. Recently, Dr. Slate created a website Writing and Statistical Help[4] to assist students and faculty with both statistical assistance and in editing/writing their dissertations/theses and manuscripts.

[1] This content is available online at <http://cnx.org/content/m37335/1.6/>.
[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[3] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
[4] http://www.writingandstatisticalhelp.com

Ana Rojas-LeBouef is a Literacy Specialist at the Reading Center at Sam Houston State University where she teaches developmental reading courses. She recently completed her doctoral degree in Reading, where she conducted a 16-year analysis of Texas statewide data regarding the achievement gap. Her research interests lie in examining the inequities in achievement among ethnic groups. Dr. Rojas-LeBouef also assists students and faculty in their writing and statistical needs on the website Writing and Statistical Help.[5]

Editors Information

Theodore B. Creighton, is a Professor at Virginia Tech and the Publications Director for NCPEA Publications[6] , the Founding Editor of Education Leadership Review,[7] and the Senior Editor of the NCPEA Connexions Project.

Brad E. Bizzell, is a recent graduate of the Virginia Tech Doctoral Program in Educational Leadership and Policy Studies, and is a School Improvement Coordinator for the Virginia Tech Training and Technical Assistance Center. In addition, Dr. Bizzell serves as an Assistant Editor of the NCPEA Connexions Project in charge of technical formatting and design.

Janet Tareilo, is a Professor at Stephen F. Austin State University and serves as the Assistant Director of NCPEA Publications. Dr. Tareilo also serves as an Assistant Editor of the NCPEA Connexions Project and as a editor and reviewer for several national and international journals in educational leadership.

Thomas Kersten is a Professor at Roosevelt University in Chicago. Dr. Kersten is widely published and an experienced editor and is the author of Taking the Mystery Out of Illinois School Finance[8] , a Connexions Print on Demand publication. He is also serving as Editor in Residence for this book by Slate and LeBouef.

10.2 Nonparametric One-Way Analysis of Variance

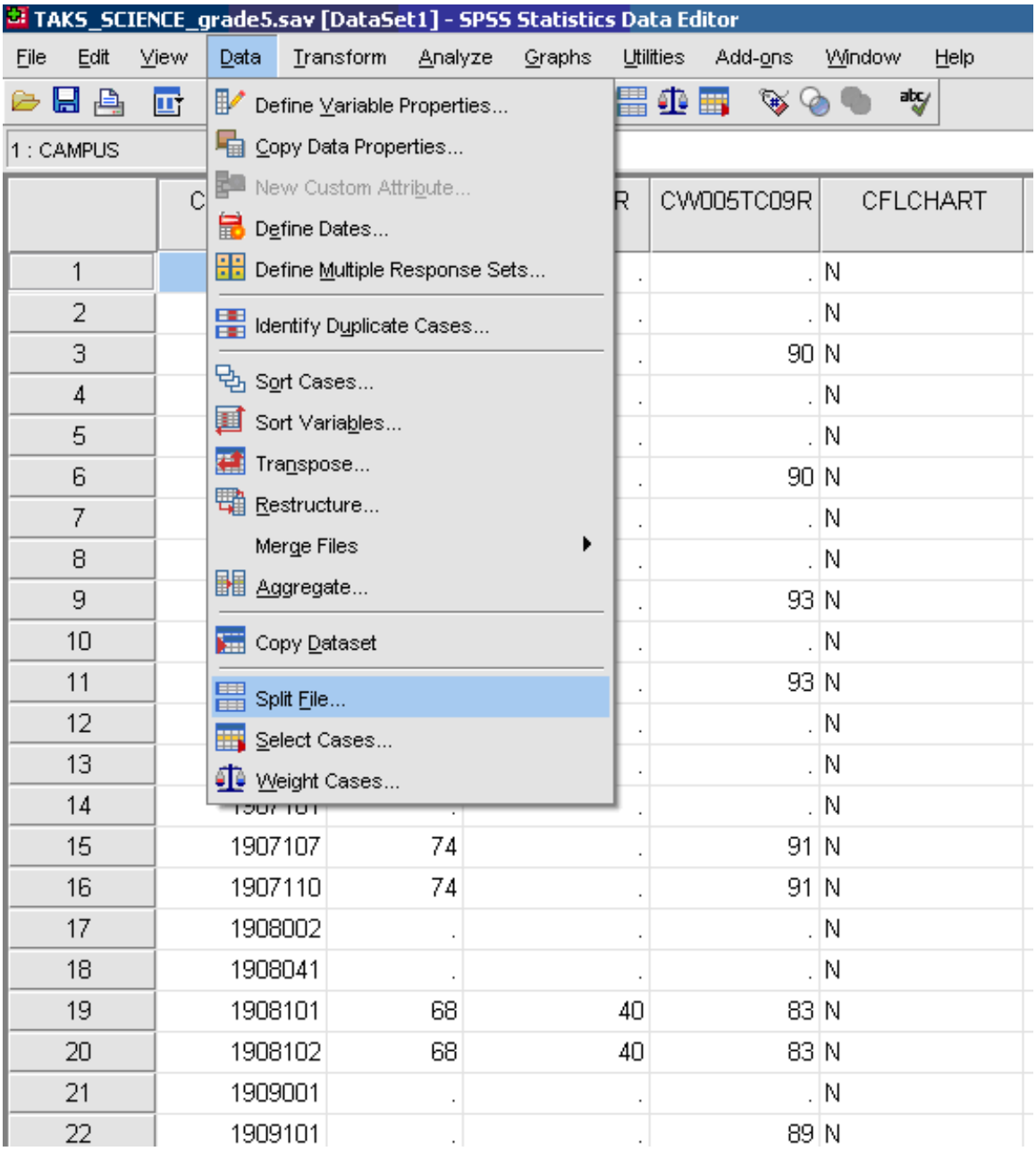
In this set of steps, readers will calculate either a parametric or a nonparametric statistical analysis, depending on whether the data for the dependent variable reflect a normal distribution. A parametric statistical procedure requires that its data be reflective of a normal curve whereas no such assumption is made in the use of a nonparametric procedure. Of the two types of statistical analyses, the parametric procedure is the more powerful one in ascertaining whether or not a statistically significant difference, in this case, exists. As such, parametric procedures are preferred over nonparametric procedures. When data are not normally distributed, however, parametric analyses may provide misleading and inaccurate results. According, nonparametric analyses should be used in cases where data are not reflective of a normal curve. In this set of steps, readers are provided with information on how to make the determination of normally or nonnormally distributed data. For detailed information regarding the assumptions underlying parametric and nonparametric procedures, readers are referred to the Hyperstats Online Statistics Textbook at http://davidmlane.com/hyperstat/ or to the Electronic Statistics Textbook (2011) at http://www.statsoft.com/textbook/

For this nonparametric analysis of variance procedure to be appropriately used, at least half of the standardized skewness coefficients and the standardized kurtosis coefficients must be outside the normal range (+/-3, Onwuegbuzie & Daniel, 2002). Research questions for which nonparametric analysis of variance procedures are appropriate involve asking for differences in a dependent variable by group membership (i.e., more than two groups may be present). The research question, "What is the difference in science performance among middle school students as a function of ethnic membership?" could be answered through use of a nonparametric analysis of variance procedure.

[5] http://www.writingandstatisticalhelp.com
[6] http://www.ncpeapublications.org
[7] http://ncpeapublications.org/about-elr.html
[8] http://cnx.org/content/col10606/latest/

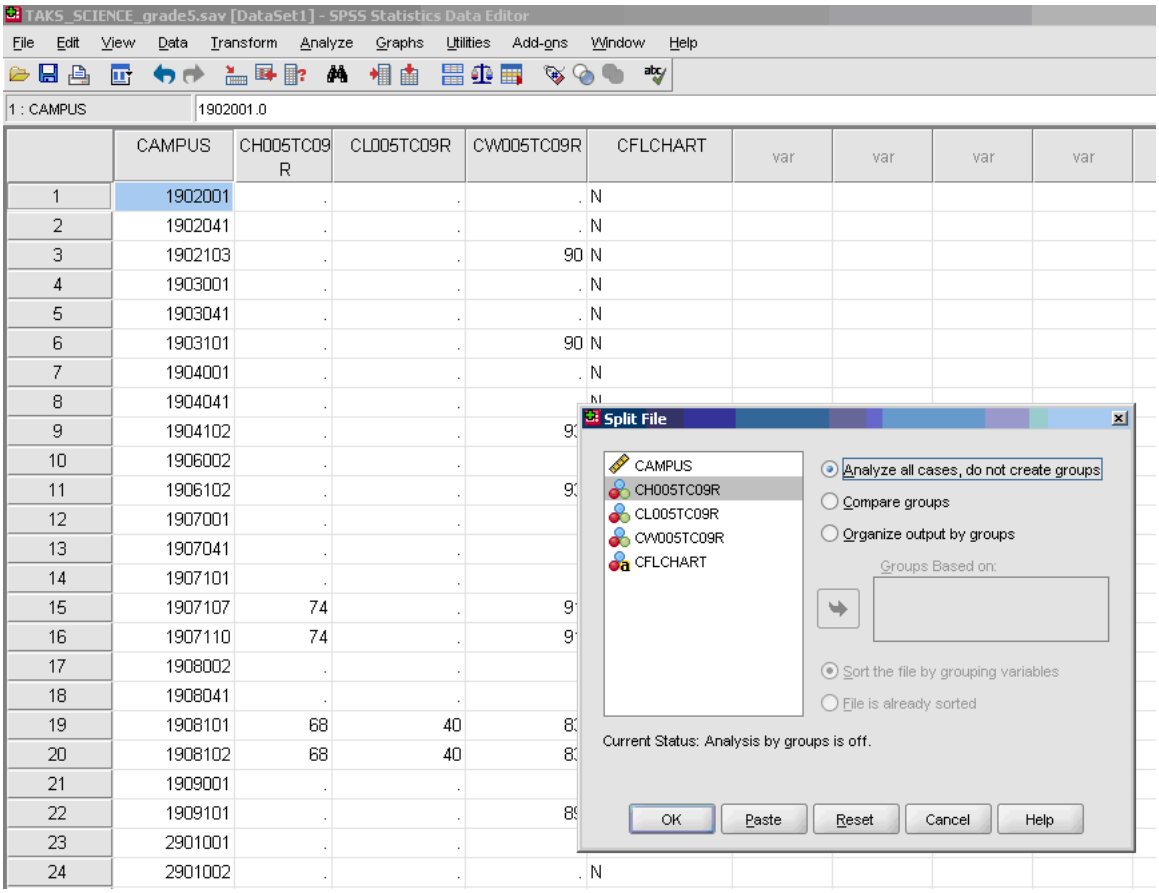
10.2.1 Step One:

√ Split your file on the basis on your independent variable/fixed factor/grouping variable



After you do this, your screen should resemble the following:

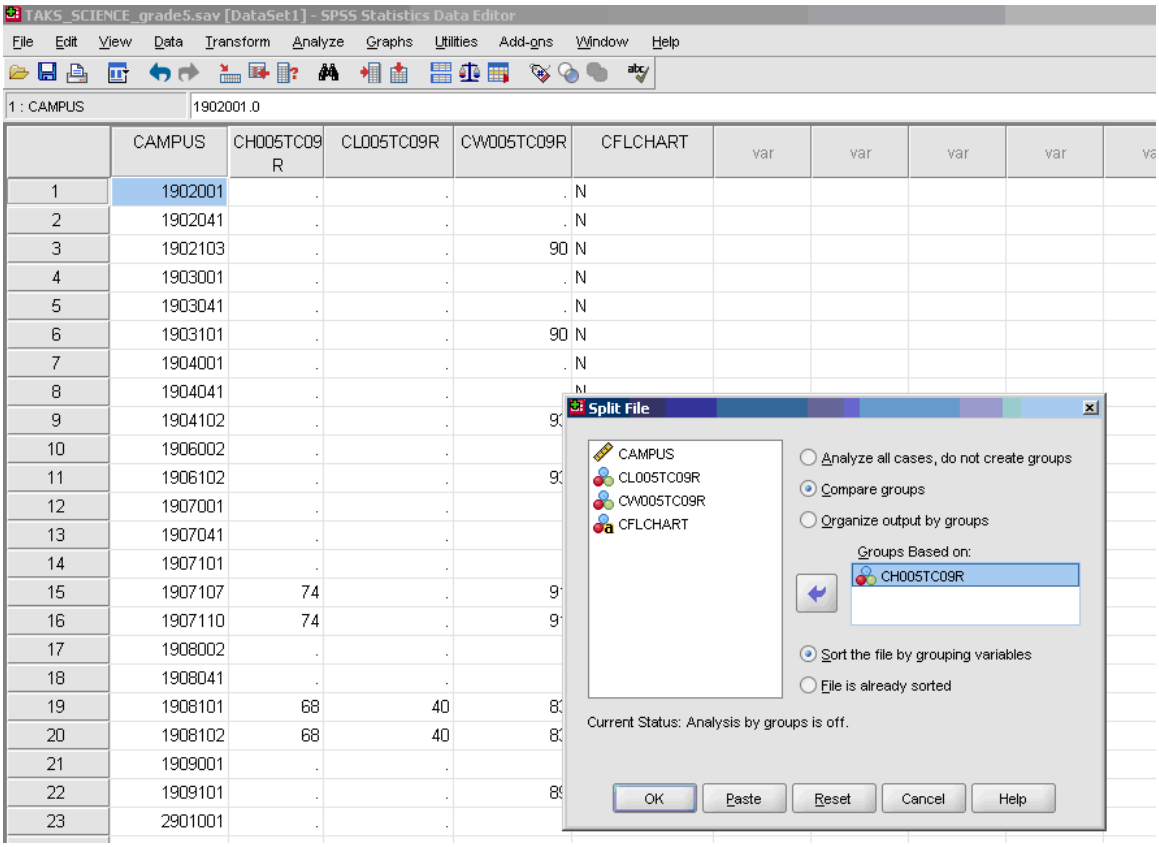
[9] http://cnx.org/content/m37335/latest/figure9.1.PNG/image



[10]

Your screen will show that all cases are going to be analyzed and a "do not create groups". You will need to click the compare groups and move the dependent variable over to the "Group Based on".

[10] http://cnx.org/content/m37335/latest/figure9.2.PNG/image

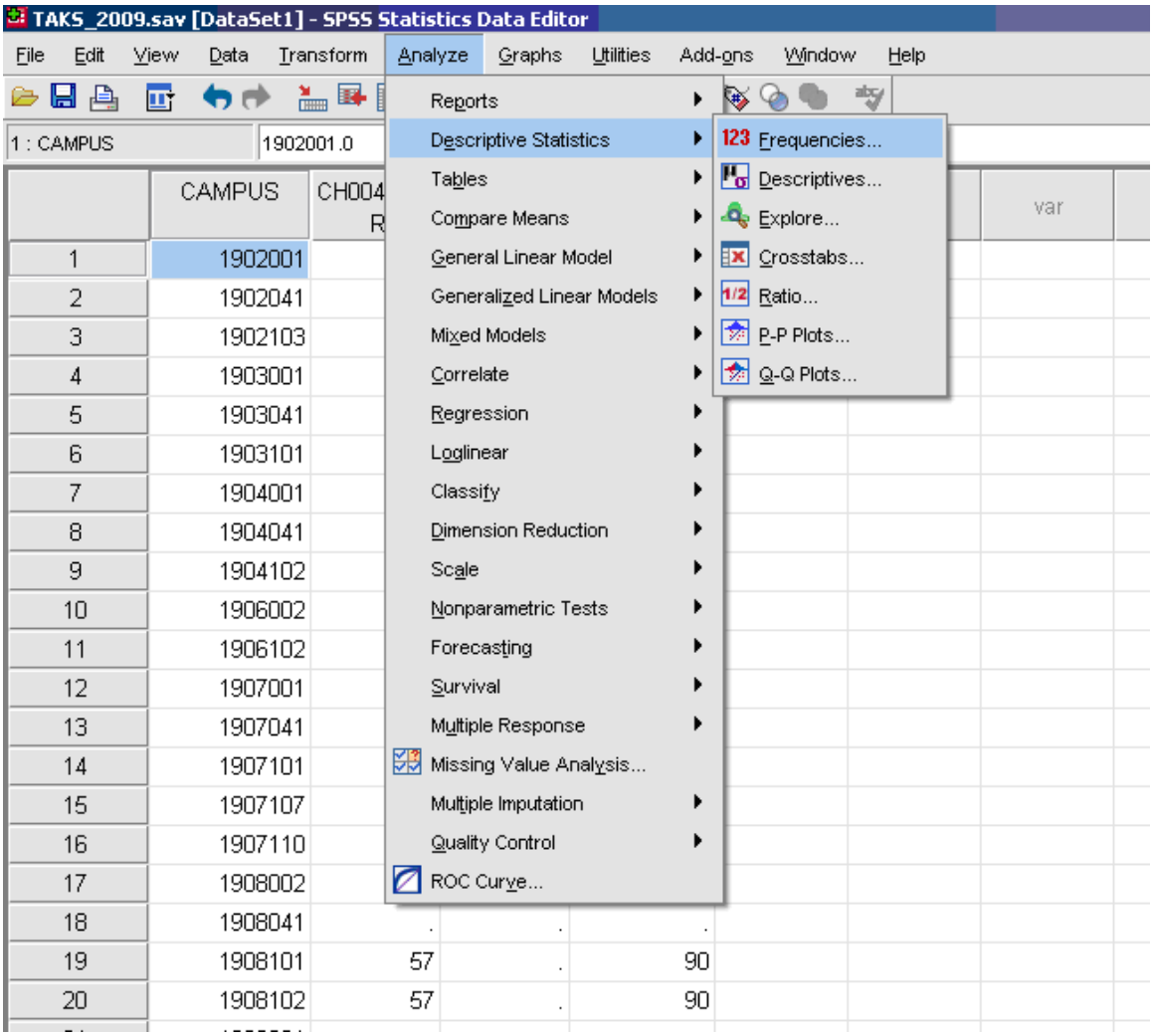


[11]

* Click OK

√ Analyze
* Descriptive Statistics
* Frequencies

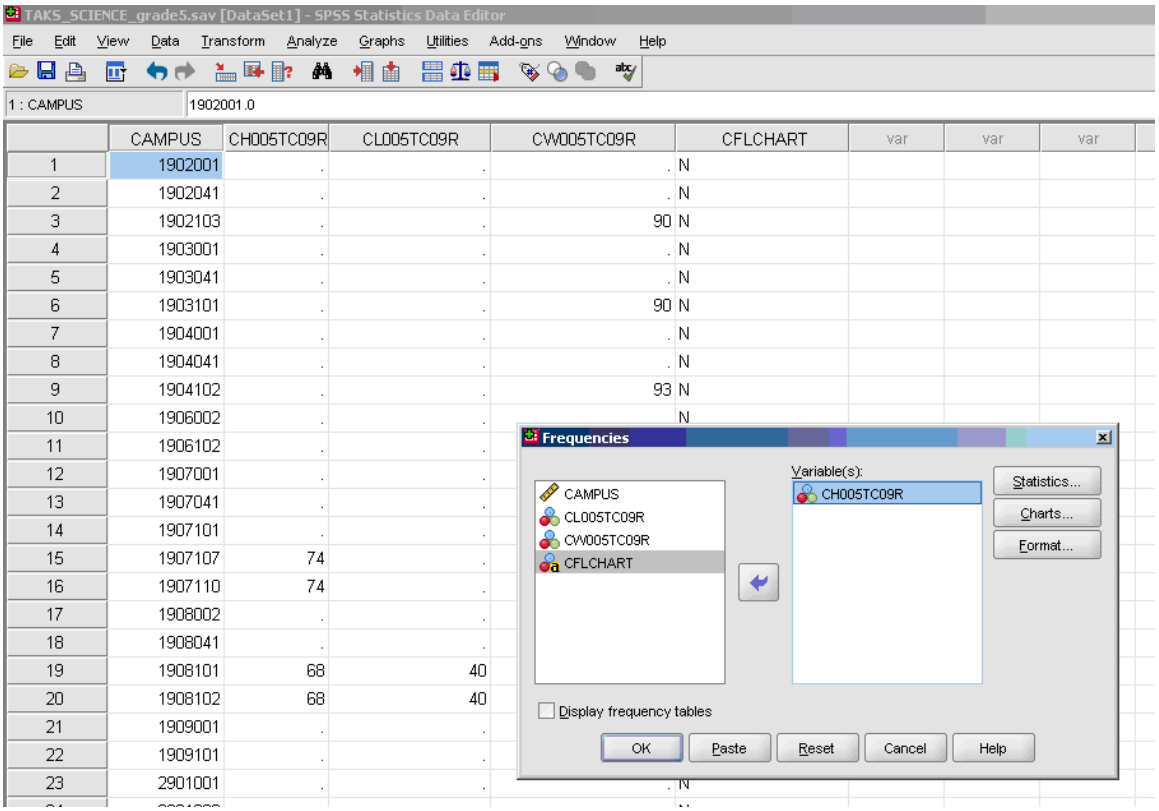
[11] http://cnx.org/content/m37335/latest/figure9.3.PNG/image



[12]

√ Move over the dependent (outcome) variable

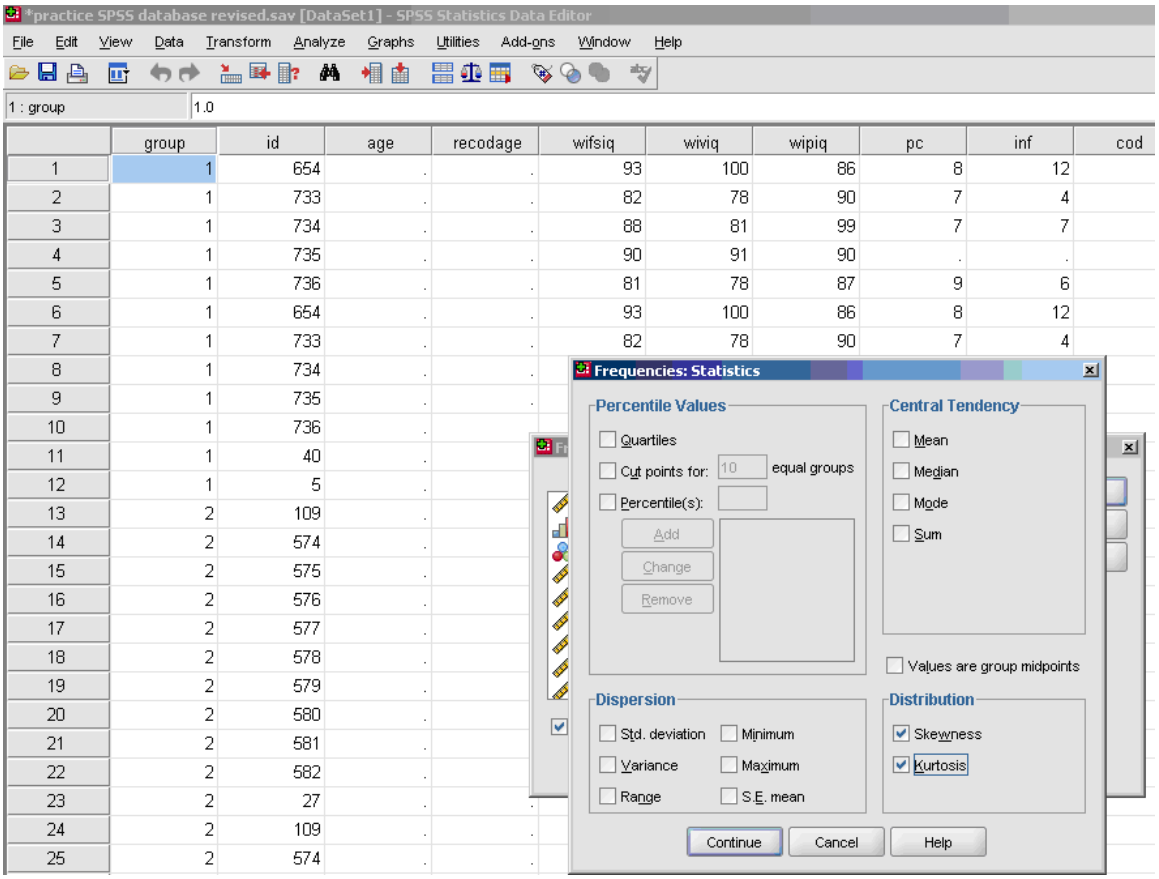
[12] http://cnx.org/content/m37335/latest/figure9.4.PNG/image



[13]

√ Click on Statistics
Your screen will look like this.

[13] http://cnx.org/content/m37335/latest/outcome.PNG/image



[14]

* Skewness [Note. Skewness refers to the extent to which the data are normally distributed around the mean. Skewed data involve having either mostly high scores with a few low ones or having mostly low scores with a few high ones.] Readers are referred to the following sources for a more detailed definition of skewness: http://www.statistics.com/index.php?page=glossary&term_id=356 and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb

To standardize the skewness value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the skewness value from the SPSS output and divide it by the Std. error of skewness. If the resulting calculation is within -3 to +3, then the skewness of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside of this +/-3 range, the dataset is not normally distributed.

* Kurtosis [Note. Kurtosis also refers to the extent to which the data are normally distributed around the mean. This time, the data are piled up higher than normal around the mean or piled up higher than normal at the ends of the distribution.] Readers are referred to the following sources for a more detailed definition of kurtosis: http://www.statistics.com/index.php?page=glossary&term_id=326 and http://www.statsoft.com/textbook/basic-statistics/#Descriptive%20statisticsb

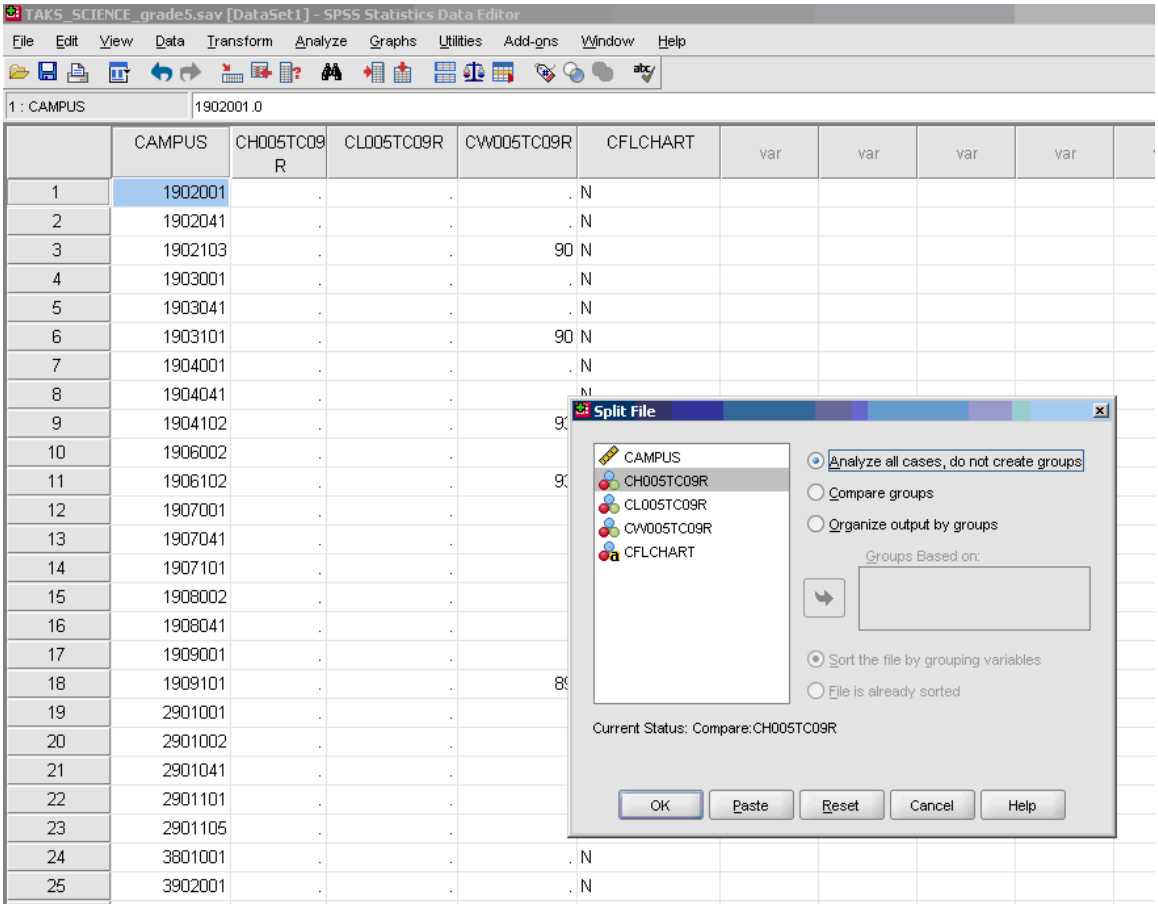
To standardize the kurtosis value so that its value can be constant across datasets and across studies, the following calculation must be made: Take the kurtosis value from the SPSS output and divide it by the Std. error of kurtosis. If the resulting calculation is within -3 to +3, then the kurtosis of the dataset is within the range of normality (Onwuegbuzie & Daniel, 2002). If the resulting calculation is outside of this +/-3 range, the dataset is not normally distributed.

* Continue
* OK

[14] http://cnx.org/content/m37335/latest/figure9.6.PNG/image

Note: Before you continue to another application you must "UNSPLIT" the files before moving on to other steps:

√ Data
√ Split Files
√ Analyze all cases, do not create groups
√ OK



[15]

Check for Skewness and Kurtosis values falling within/without the parameters of normality (-3 to +3). Note that each variable below has its own skewness value and its own kurtosis value. Thus, a total of three standardized skewness coefficients and three standardized kurtosis coefficients can be calculated from information in the table below.

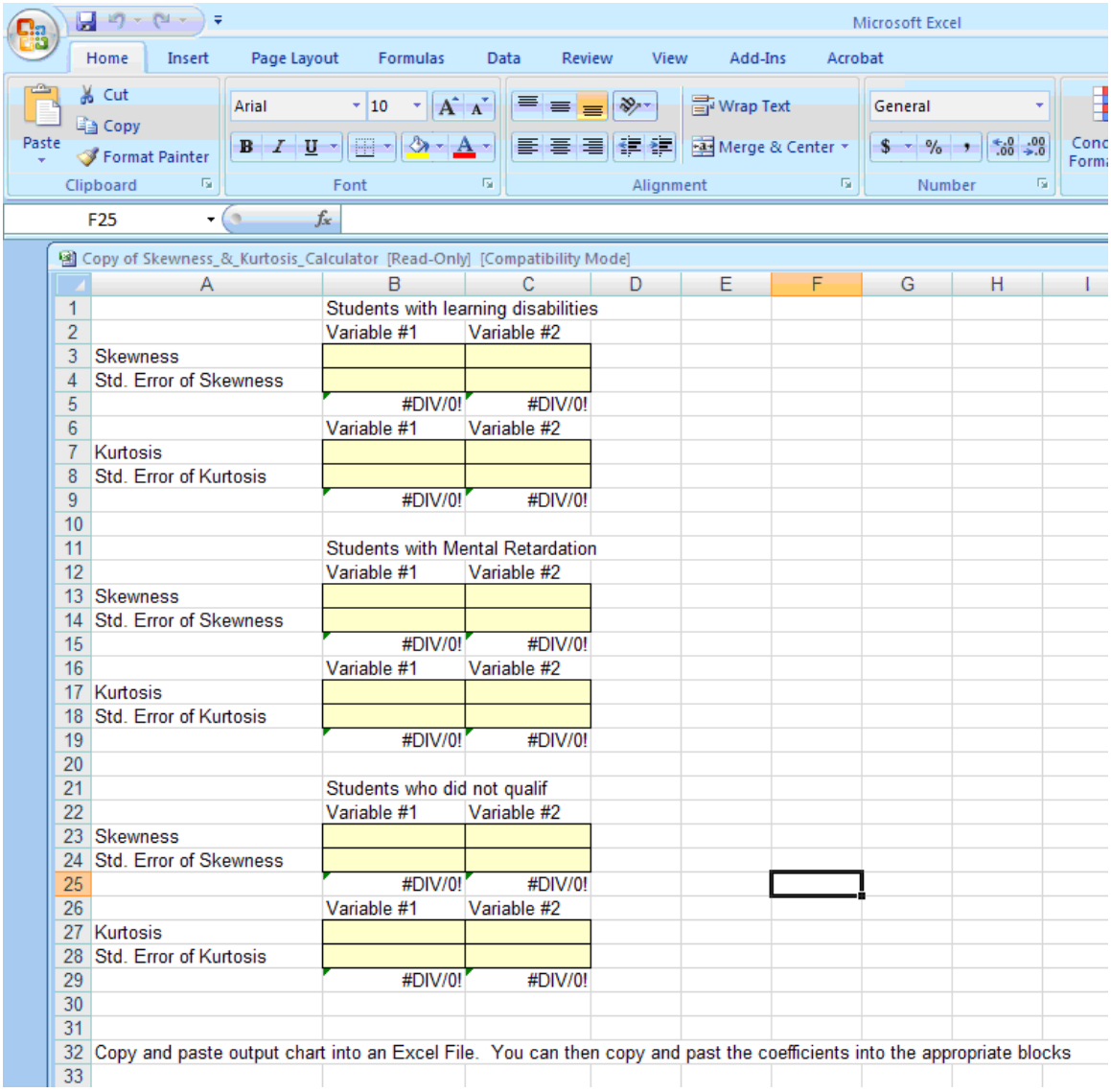
[15] http://cnx.org/content/m37335/latest/figure9.7.PNG/image

Skewness and Kurtosis Coefficients

	CH005TC09R	CL005TC09R	CW005TC09R
N Valid	3125	1805	1877
Missing	5197	6517	6445
Skewness	**-1.129**	**-.479**	**-2.197**
Std. Error of Skewness)	**.044**	**.058**	**.056**
Kurtosis	**1.818**	**-.412**	**6.991**
Std. Error of Kurtosis	**.008**	**.115**	**.113**

Table 10.1

Copy skewness and kurtosis information into the skewness and kurtosis calculator



[16]

10.2.2 Step Two:

Compute Descriptive Statistics on the Dependent Variable

* Do so via the ANOVA procedure.
* Note. Do not use the ANOVA statistical significance information provided in the output. Use only the *M*s, *SD*s, and *n*s.
* **The screen shot will occur in the next step** (Mean and standard deviation)

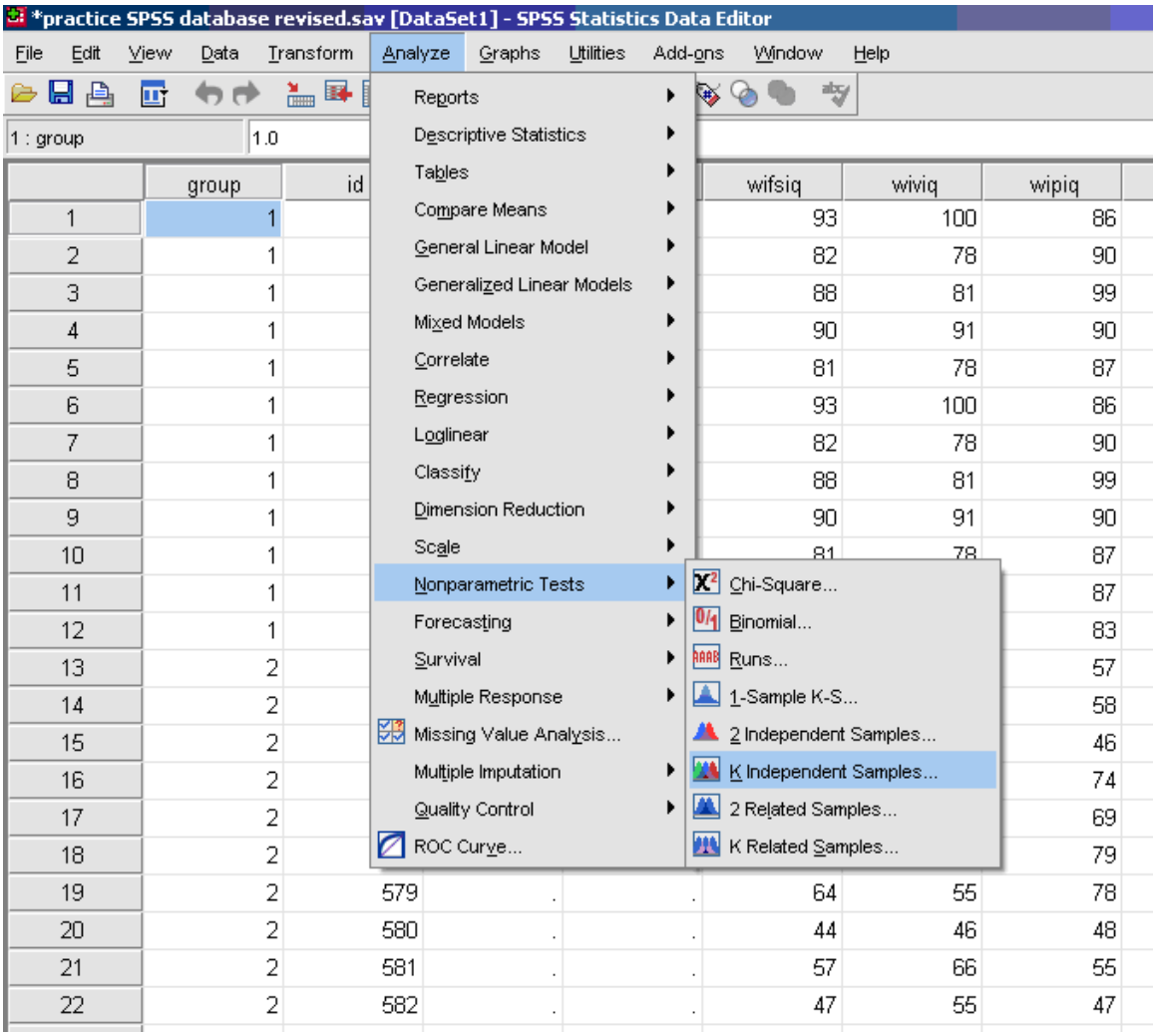
10.2.3 Step Three:

Run Nonparametric One-Way ANOVA on Data

* Analyze
* Nonparametric Tests

[16] http://cnx.org/content/m37335/latest/calc.PNG/image

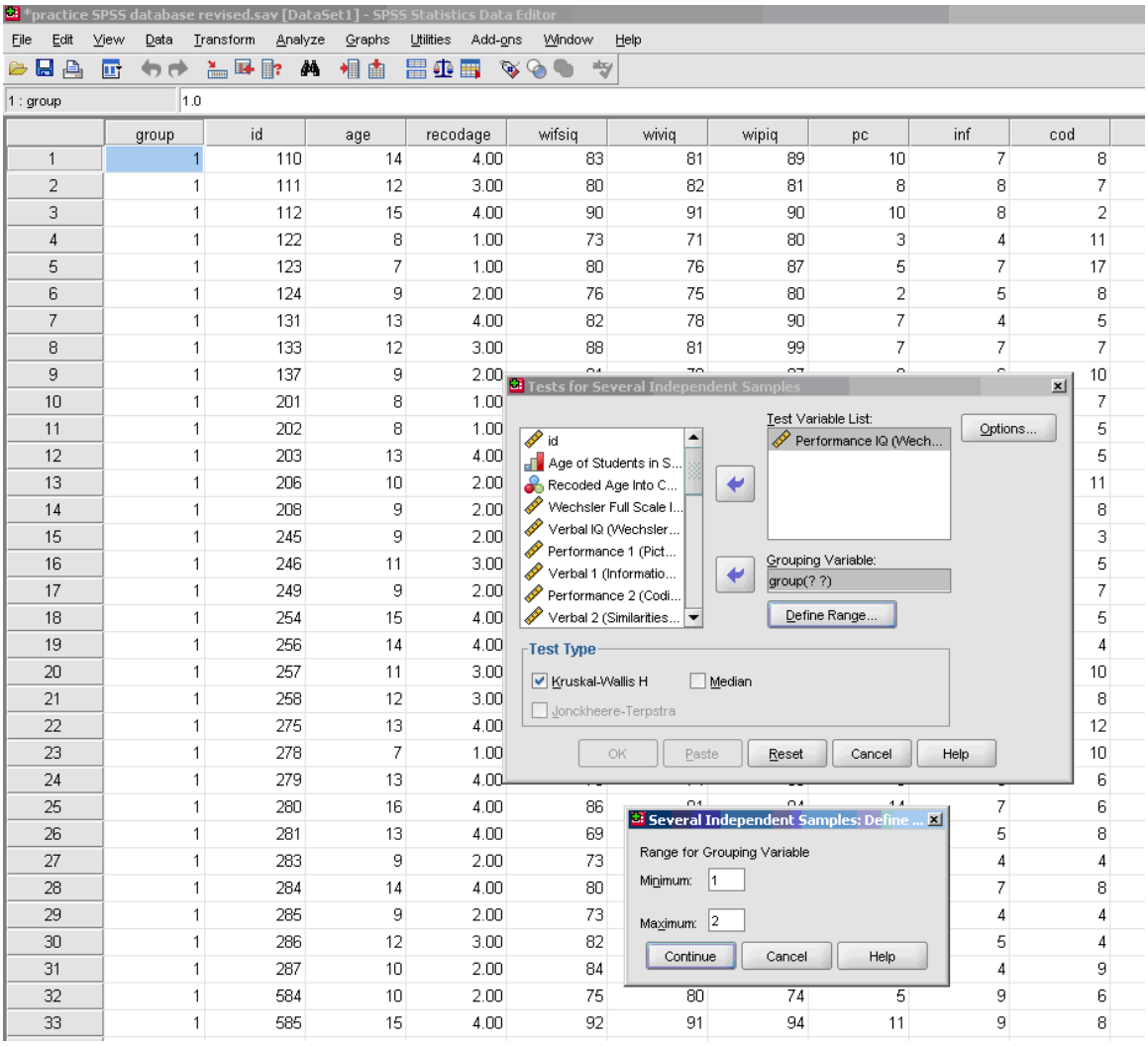
* k Independent Samples



[17]

* Keep the default of Kruskal-Wallis H checked

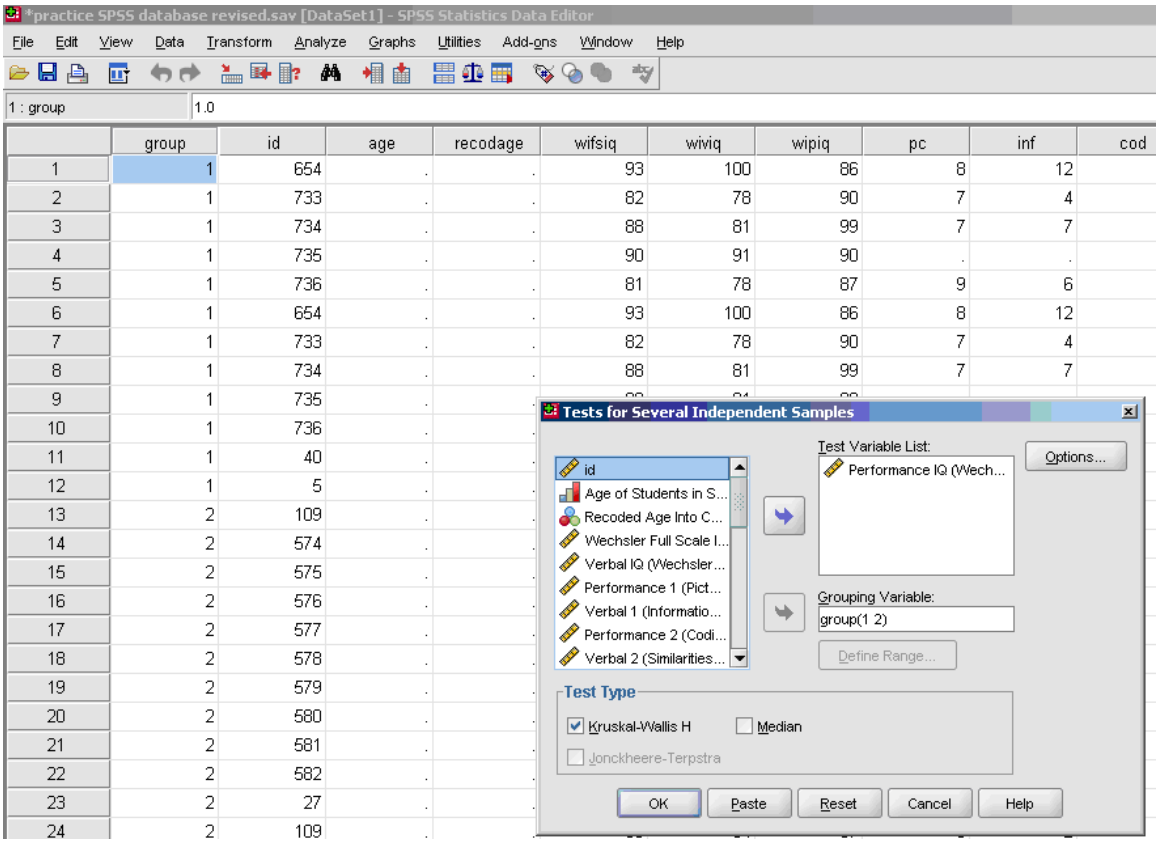
[17] http://cnx.org/content/m37335/latest/figure9.8.PNG/image



[18]

* Test Variable would be your Dependent Variable (e.g., test scores)
* Grouping Variable would be your Independent Variable (categories)
* Define Groups
* Insert the number for your lowest numbered group and then the number for your highest numbered group.

[18] http://cnx.org/content/m37335/latest/figure9.10PNG/image



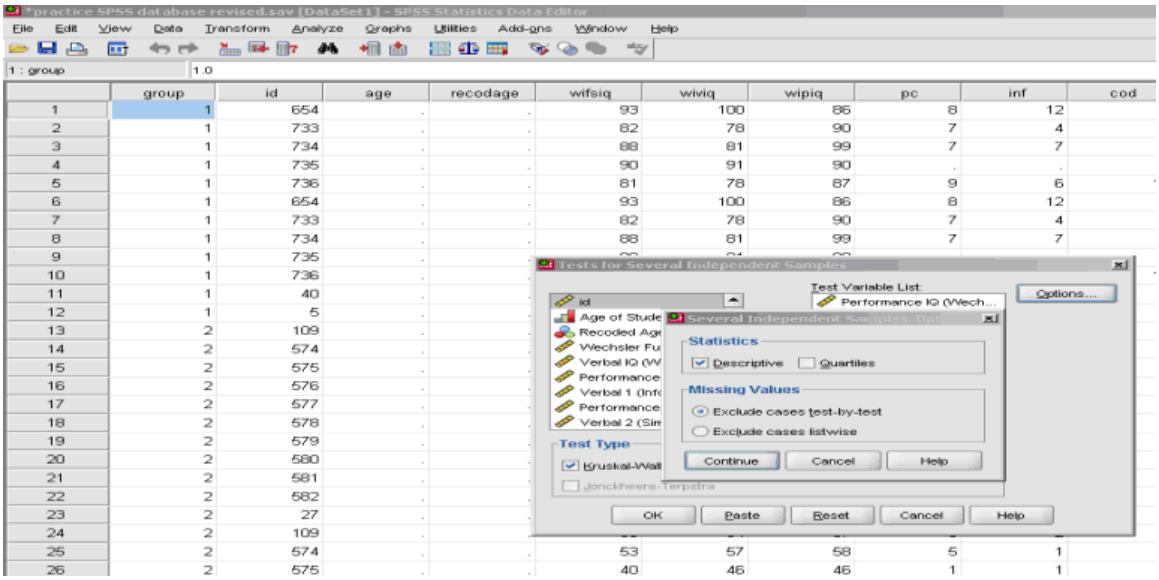
	group	id	age	recodage	wifsiq	wiviq	wipiq	pc	inf	cod
1	1	654	.	.	93	100	86	8	12	
2	1	733	.	.	82	78	90	7	4	
3	1	734	.	.	88	81	99	7	7	
4	1	735	.	.	90	91	90	.	.	
5	1	736	.	.	81	78	87	9	6	
6	1	654	.	.	93	100	86	8	12	
7	1	733	.	.	82	78	90	7	4	
8	1	734	.	.	88	81	99	7	7	
9	1	735	.							
10	1	736	.							
11	1	40	.							
12	1	5	.							
13	2	109	.							
14	2	574	.							
15	2	575	.							
16	2	576	.							
17	2	577	.							
18	2	578	.							
19	2	579	.							
20	2	580	.							
21	2	581	.							
22	2	582	.							
23	2	27	.							
24	2	109	.							

[19]

Note: Click on view than value labels to find the code for each group.
* Continue

** To obtain the Means and Standard Deviation:
* Click on options
* Highlight Descriptive
* Click Continue

[19] http://cnx.org/content/m37335/latest/figure9.9.PNG/image



[20]

* OK

10.2.4 Step Four:

Check for Statistical Significance
Numerical sentence is written as: $X^2 = 430.66$, $p < .001$

Test Statistics[a,b]

	Performance IQ (Wechsler Performance Intelligence 3)
Chi-Square	430.661
df	1
Asymp. Sig.	**.000**

Table 10.2

a. Kruskal Wallis Test
b. Grouping Variable: Disability Group Membership

10.2.5 Step Five:

If you have a statistically significant finding in your nonparametric ANOVA, you need to run the appropriate nonparametric post hocs. Refer to your steps on running the nonparametric independent samples *t*-test.

[20] http://cnx.org/content/m37335/latest/figure9.11.PNG/image

10.2.6 Step Six:

Calculate Nonparametric Independent Samples t -test on Data
√ Analyze
√ Nonparametric Tests
√ 2 Independent Samples
√ Test Variable would be your Dependent Variable (e.g., test scores)
√ Grouping Variable would be your dichotomous Independent Variable
√ Define Groups
√ Group One is No. 1 and Group Two is No. 2 (or whatever numbers you used to identify each group)
Note: Click on view then value lables to find the code for each group
√ Continue
√ OK
Note. The above procedure is repeated for each pairwise comparison. Thus, if you have three groups, you would have three calculations. Correct for inflated error by using the Bonferroni method of adjustment. Take the number of pairwise comparisons you are calculating and divide .05 by that.

Check for Statistical Significance
1. Go to the Test Statistics Box and look at the cell in the bottom right column to check for statistical significance.

If you have any value less than .05 then you have statistical significance. Remember to replace the third zero with a 1, if the value is .000 (i.e., for a sig value of .000, thus it would read .001).

Test Statistics[a]

	Performance IQ (Wechsler Performance Intelligence 3)
Mann-Whitney U	6765.500
Wilcoxon W	44166.500
Z	-20.752
Asymp. Sig. (2-tailed)	**.000**

Table 10.3

a. Grouping Variable: Disability Group Membership

To determine how to report the results of these nonparametric followup procedures, see the chapter on nonparametric independent samples t-test in this book.

10.3 Writing Up Your Nonparamteric ANOVA

So, how do you "write up" your Research Questions and your Results? Schuler W. Huck (2000) in his seminal book entitled, *Reading Statistics and Research,* points to the importance of your audience understanding and making sense of your research in written form. Huck further states:

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[27] http://www.statsoft.com/textbook/

Chapter 11

Standardized Skewness and Standardized Kurtosis Coefficient Calculator[1]

11.1 Skewness and Kurtosis Calculator

The Standardized Skewness and Kurtosis Coefficient Calculator is to be used with the Book, ***Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts*** authored by Professors John R. Slate and Ana Rojas-LeBouef.

Do not try to OPEN the file from here. DOWNLOAD the Excel file to your desktop, where you can use the Calculator to create your Skewness and Kurtosis coefficients.

Click here to download the Skewness and Kurtosis Excel file to your desktop.[2]

[1] This content is available online at <http://cnx.org/content/m37347/1.3/>.

[2] See the file at <http://cnx.org/content/m37347/latest/Standardized_Skewness_and_Standardized_Kurtosis_Coefficient_Calculator.xls>

Chapter 12

Resources: Calculating Basic Statisictics in SPSS[1]

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[2] http://my.qoop.com/store/NCPEA-Publications-1781472103076212/
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[9] http://www.statsoft.com/textbook/

Attributions

Collection: *Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts*
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By: John R. Slate, Ana Rojas-LeBouef
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Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts

Calculating Basic Statistical Procedures in SPSS: A Self-Help and Practical Guide to Preparing Theses, Dissertations, and Manuscripts, is authored by John R. Slate and Ana Rojas-LeBouef from Sam Houston State University. This book is written to assist graduate students and faculty members, as well as undergraduate students, in their use of the Statistical Package of the Social Sciences-PC (SPSS-PC) versions 15-19. Specifically, we have generated a set of steps and screenshots to depict each important step in conducting basic statistical analyses. We believe that this book supplements existing statistical texts in which readers are informed about the statistical underpinnings of basic statistical procedures and in which definitions of terms are provided. Accordingly, other than providing a few basic definitions, we assume that dissertation chairs/thesis directors, students, and/or faculty will obtain their own definition of terms. We hope you find this set of steps and screenshots to be helpful as you use SPSS-PC in conducting basic statistical analyses.

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